

**EFFECT OF CREDIT ACCESS ON INCOME AMONG SMALL SCALE YOUTH
TOMATO FARMERS IN MVOMERO DISTRICT TANZANIA**

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**A Thesis Submitted to the Graduate School in Partial Fulfilment of the
Requirements for the Master of Science Degree in Agribusiness Management of
Egerton University**


EGERTON UNIVERSITY

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented in this university or any other for the award of a degree.

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DEDICATION

This thesis is dedicated to my parents, Andrew and Ruth Too, and siblings Peter, Abigail, and Mercy. Thank you.

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I sincerely thank God for granting me good health that enabled me to complete this master's program, enrolment at Egerton University for MSc. Agribusiness Management was indeed God's doing. I wish to acknowledge the support of the International Institute of Tropical Agriculture (IITA) for financing my research work. Much appreciation goes to my supervisors, Prof. Ngigi, Dr. Gathungu, and Dr. Manyong, for their insightful comments and suggestions that enabled me to complete this work. To all my colleagues and friends, thank you for your moral support. It has not been easy, and I appreciate you all. Lastly, I thank the lead enumerators, Jires and Samata, the enumerators, and all respondents who participated in the data collection. May the Almighty God bless you and richly reward you.

ABSTRACT

Despite the potential that the agriculture sector holds to contribute to reducing the high unemployment levels among the youth, the sector remains largely untapped. Youth farmers struggle to get access to credit for agricultural activities, which is critical for the purchase of inputs and setting up of agricultural investments. This study looked into the effect of access to credit on income among small-scale youth tomato farmers in Mvomero district, Tanzania. Tanzania is largely endowed with arable land and favourable weather conditions for agricultural production. The first objective sought to determine the perceptions of youth on the process of accessing credit from lending institutions. The second objective reviewed the determinants of credit access and the third objective analysed the impact of credit on income. A sample of 562 youth were interviewed for the study and the data analysed using STATA software. For the first objective the exploratory factor analysis (EFA) was used and the findings show that youth perceive the process of seeking and applying for credit as cumbersome and the procedures complex. The second objective was analysed using the binary logit regression model and the results found that level of education, years of farming experience, land size, gender, group membership, and distance to lending institutions were significant in determining access to credit. The third objective was analysed using the propensity score matching technique (PSM). The PSM results show that access to credit increases farm income as it allows the purchase of quality inputs and investment in farm activities. Additionally, income from farmers borrowing from formal institutions was higher than those acquiring loans from informal channels. In conclusion, uptake of agricultural credit among youth farmers can be increased through financial literacy, youth-friendly packages, and simplified and inclusive loan application and requirements. Further research is proposed to explore other factors that can enhance youth engagement in agriculture and the impact of access to credit across various value chains.

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LIST OF ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
ASDS	Agricultural Sector Development Strategy
BOA	Bank of Agriculture (Nigeria)
EFA	Exploratory Factor Analysis
FAO	Food and Agriculture Organization of the United Nations
FBOs	Farmer Based Organizations
FIML	Full Information Maximum Likelihood
GDP	Gross Domestic Product
HODECT	Horticultural Development Council of Tanzania
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IMR	Inverse Mills Ratio
LMICs	Low- and Middle-Income Countries
MFI	Microfinance Institutions
NSGRP	The National Strategy for Growth and Reduction of Poverty
NSYIA	National Strategy for Youth Involvement in Agriculture
PSM	Propensity Score Matching
SACCO	Savings and Credit Cooperative
SSA	Sub-Saharan Africa
SUGECO	Sokoine University Graduate Entrepreneurs Cooperative
TADB	Tanzania Agricultural Development Bank
UNDP	United Nations Development Programme
YEEA	Youth Economic Empowerment through Agribusiness

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Majority of the low- and middle-income countries (LMICs) are dependent on agriculture for exports, employment and food security (FAO, 2017). In these countries, the agriculture sector employs about 60% of the residents and contributes over 25% in Gross Domestic Product (GDP) (FAOSTAT, 2022; United Nations, 2023). In spite of this, residents continue to face high levels of poverty and food security because of low farm production. The farming population is gradually ageing and the average age is sixty years. The implication of the ageing population is decreased farm production resulting from low adoption of technologies and diminished strength and vigour (FAO *et al.*, 2014; HelpAge International, 2014).

Consequently, governments and development partners with this grim realization have come out to support the revitalization of the agriculture sector through the empowerment of youth to join in developing and contributing to the sector's growth. The youth's high appetite for risk and technology is promising to raise the sectors' contribution and adaptation even in the face of climate change (Gebre *et al.*, 2019; Jumba *et al.*, 2020; Yigezu *et al.*, 2018). Through adoption of technologies into farming activities, the sector not only benefits from improved production levels but also employment creation for young people. Horticulture is one of the key areas that has interested young people due to the small space requirement, short waiting period and high-income levels (IFPRI, 2012; Journal *et al.*, 2015).

In the case of Tanzania, agriculture contributes about 29% of the Gross Domestic Product (GDP), with 40% realized from exports and 75% of the population employed in the sector. This positions the agriculture sector as a critical cog for the transformation of the economy and also for the improvement of livelihoods of the citizens (FAOSTAT, 2022). Of the total population, those below 35 years make up 77%, with youth aged between 15 and 34 years comprising 34.7%. For this study, youth are defined as individuals between 18 and 35 years. Despite the National Youth Development Policy of 2007 defining a youth as aged 15 to 35 years, the legally recognized age is 18 years, where one can engage in formal activities of economic development.

The national youth unemployment rate in Tanzania was 9.7% in 2021, where youth unemployment accounted for 13.4% (URT, 2022). This presents both an opportunity and a challenge. As an opportunity, it indicates the percentage of youth available to offer who if not

meaningfully engaged could also serve as a challenge with some engaging in unlawful activities. The farming of tomatoes is an opportunity to gainfully engage youth by creating employment opportunities and a source of income. Tomatoes are widely known for their short growing period, high profits and the constant demand by locals and also for export to neighbouring countries (Mrema *et al.*, 2017; Ng'atigwa *et al.*, 2020).

Tomatoes in Tanzania is widely grown with over 26,000 hectares, taking lead in the East Africa region and the produce is exported to Zambia, Kenya, Comoros among other countries. Despite the growing demand for tomatoes, farm production is still low and does not sufficiently meet the quantities required. One of the reasons is the production methods, that is, low adoption of technologies and inadequate financing as tomato production is a capital-intensive venture (Mutayoba, 2018). To meet the growing market demand access to credit is critical as it allows farmers to purchase quality inputs, meet their labour requirement and invest in irrigation technologies (Chandio *et al.*, 2017; Mushi *et al.*, 2022). Additionally, agricultural credit allows for the commercialization of farming activities enabling farmers to expand their farm enterprises from subsistence to market-oriented.

Of the overall population, only 6% of residents in Tanzania have access to bank credit with 1% being loans issued for agricultural purposes (Sanka & Nkilikiwa, 2021). The low access and uptake of agricultural credit have slowed expansion of farm activities among rural dwellers and consequently leading to low living standards and food insecurity (Mbelu & Ifionu, 2022; Owusu, 2017). The availability of credit is crucial for employment creation which also serves to improve farm production levels and ultimately reduces poverty (Afari-Sefa *et al.*, 2018; Benjamin *et al.*, 2015; Herliana *et al.*, 2018). Therefore, improving access to credit enhances the ability of smallholder and youth farmers to modernize their agricultural activities and invest in their agribusiness ventures (Kosgey, 2013).

When dispensing agricultural credit, it is not limited to only cash and loans, but also includes in-kind support and services such as provision of inputs (seed and fertilizers), agrochemicals, land preparation services, spray services and post-harvest storage equipment and services (Sedem *et al.*, 2016). However, in most rural areas these services are not available and are often limited by stringent lending requirements and high interest rates which inhibits their uptake by youth farmers (Dimo *et al.*, 2022). Investment in agricultural infrastructure is crucial to build the resilience of farmer to changing climate and weather patterns and also cushions them against market uncertainties (Nasereldin *et al.*, 2023).

Whereas agricultural credit plays a crucial role, there are other factors that influence farmers' incomes such as use of quality inputs and technologies, access to extension services, access to markets and market information. Access to markets is a deal-breaker as it determines, the prices and profitability of farm produce. During glut periods, farmers often sell at low farm-gate prices or stand the risk of losing their produce because of limited storage facilities (Kipkogei *et al.*, 2025).

1.2 Statement of the problem

Smallholder farmers are the main producers of tomatoes in Tanzania which is a great employment opportunity for young people. Despite the potential that tomato farming holds for the youth, inadequate access to financing facilities needed to purchase inputs is largely limited. Additionally, there is limited use of technologies in farm operations which has further contributed to the low productivity. Majority of the farmers practice agriculture using traditional methods and, in some cases, grow crops without the recommended input ratios.

Several factors limit access to credit by small-scale farmers, they include institutional, financial, and socio-economic factors. Among the youth, the challenges are greater due to their limited ownership of assets (usually required as collateral), lack of financial history, among other age-based biases in credit and finance markets. Despite credit being a critical tool for enhancing agricultural production and income, previous studies have focused solely on the overall farming population without paying particular attention to the unique challenges and factors facing young farmers.

This gap in literature has critical policy implications for governments, development partners and other stakeholders who are largely involved in empowering youth in agriculture activities. Understanding how access to credit affects income specifically among youth farmers, is crucial to develop policies and targeted agricultural interventions beneficial to them. This study reviewed the variables that inform the access to agricultural loans from formal and informal institutions and the resultant effect on income among youth tomato farmers in Mvomero District.

1.3 Objectives of the study

1.3.1 General objective

To contribute to increased income amongst youth tomato farmers by analyzing factors influencing credit access in Mvomero district, Tanzania.

1.3.2 Specific objectives

- i. To determine the perceptions of small-scale youth tomato farmers in Mvomero district on ease of access to agricultural credit.
- ii. To identify determinants of access to agricultural credit by small-scale youth tomato farmers in Mvomero district, Tanzania.
- iii. To estimate the effect of agricultural credit on tomato income among small-scale youth tomato farmers in Mvomero district, Tanzania.

1.4 Research questions

- i. How do small-scale youth tomato farmers in Mvomero district, Tanzania perceive the ease of access to agricultural credit?
- ii. What factors determine access to agricultural credit by small-scale youth tomato farmers in Mvomero district, Tanzania?
- iii. How does access to agricultural credit affect income among youth tomato farmers in Mvomero district, Tanzania?

1.5 Justification and significance of the study

The agriculture sector in developing countries is widely acknowledged in employment creation and reduction of poverty levels. However, a few challenges limit the sector's overall productivity and performance. Financial challenges have crippled ongoing efforts to incentivize youth to join agriculture. Young people are often left out of the formal institutions borrowing systems due to limited borrowing history, lack of assets (collateral) and other intrinsic barriers within the system. Despite a couple of programs that have supported agricultural activities in the country, there is limited evidence on how youth have been supported to access loans and the effect of it on their livelihoods. Therefore, this forms the basis of the study, as it reviews how the utilization of credit in agricultural production has affected farm level productions and incomes of young people. A comparison is also made on the effectiveness of formal and informal credit.

This study focuses on the youth mainly because they have great potential to transform the agriculture sector, as long as the necessary support and infrastructure is provided to them. Therefore, understanding factors that affect their access to finances and its resultant impact is a critical finding that would inform the design of youth-targeted interventions. The results of this study have a crucial policy implication on measures that need to be set up to facilitate the access and utilization of credit by the youth in the agriculture sector.

Findings from this study would also be useful in policy formulation and to development partners and the government sectors.

1.6 Scope and limitation of the study

The research study, done in Mvomero district in Tanzania and focused on youth aged 18 to 35 years and actively engaged in agricultural production. The study reviewed how the income of young farmers growing tomatoes is affected by their access and use of credit. Several variables that could potentially influence the whether youth can receive credit have been reviewed by researchers and they include perceptions and attitudes, training, and access to land among others. Due to financial, time and logistical limitations the study did not cover all those factors. However, this provides an opportunity to study further on various crops and other variables that affect accessibility of loans to youth and how it affects their income.

The study, however, has some limitations, since the some of the data collected relied the respondents' ability to recall such as input purchases and income, which may may introduce recall bias or underreporting, particularly in cases where farmers have multiple sources of income and do not keep records. It was anticipated that a language barrier would arise between the researcher and the responds during data collection. Therefore, locally recruited enumerators were employed to resolve this issue. Despite the aforementioned limitations, the study provides important findings about the agricultural credit borrowing landscape.

1.7 Definition of terms

Access to agricultural credit – the ability of an individual to acquire financial support from formal or informal institutions that they can use to buy agricultural inputs or hire labour to support tomato farming, among other benefits.

Formal agricultural credit sources – formally registered financial institutions such as banks, microfinance, and SACCOs that lend financial support to smallholder farmers.

Informal agricultural credit sources – non-registered organizations or individuals who offer credit to small-scale farmers with anticipation that farmers will use the money to purchase agricultural inputs.

Youth smallholder tomato farmers – men and women between 18 to 35 years of age actively involved in tomato farming.

Youth unemployment rate – a percentage of the economically active population aged 18 to 35 without work but searching for job opportunities.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this section, an overall view of the activities of youth in agriculture in Tanzania is explored. The second sub-section reviews tomato production in Tanzania and the third on various agricultural credit programs (model and impact on farmers). The fourth delves into the how youth perceive the process of acquiring credit and the fifth on how credit affects income. Finally, the theoretical and empirical frameworks are discussed.

2.2 Youth engagement in agriculture in Tanzania: challenges and opportunities

There are growing concerns over the ageing population currently engaged in farm activities. This is amidst the outcry that young people are increasingly moving away from agriculture to the cities and urban areas in search of white-collar jobs (Geza *et al.*, 2021).

On the other hand, the youth unemployment levels have been on the rise. Hence, providing the necessary support for youth to kick-start and establish careers in the sector is of importance for both socio-economic growth and addressing unemployment among the youth (Kamuzora, 2025).

In Tanzania, youth who are below the age of 25 make up approximately 65% of the population (FAO, 2022). Among this group of youth, agriculture is not highly esteemed as a career and is not appealing. For a long time, agriculture is perceived a career that requires physical effort and with low returns (Geza *et al.*, 2021). Among the major contributing factors to the low interest of youth in agricultural activities if the limited land available for farm production, low market prices for farm produces, low access to credit facilities and extension services (Lindsjö *et al.*, 2020). For agricultural production and investment, land ownership is vital (Msangi *et al.*, 2024). Agricultural credit is also a major challenge to young people, as it limits their adoption of modern technologies for farm production. Lending institutions view youth farmers as high-risk customers since they lack sufficient collateral and credit-borrowing history which further reduces their chances of being considered for loans (Kamuzora, 2025).

Aside from the challenges highlighted above, young people have other opportunities that they can tap into along the agricultural value chain. One of them, is the application of digital tools in farming. The youth are more tech-savvy than the older farmers and have a higher chance of adopting and integrate ICT tools into their farming operations. These tools provide

farmers with various agricultural solutions such as timely weather updates for planning of farm activities, market information and prices at different locations, crop pests and disease solutions for prompt response and also marketing platforms. All these functions serve as opportunities for youth and also make farming easier (Okello *et al.*, 2020).

The government, development partners and donor organizations are increasingly funding initiatives, projects and programmes to support youth in agriculture-related activities. These projects target youth mainly to provide entrepreneurial training and where possible, seed funding in form of grants, loans and in-kind support. In Tanzania, for instance, the government developed policies and strategies, highlighting the challenges in the sector and proposed solutions. However, for the young people, removing the barriers already experienced in the sector is crucial to winning them back (Lindsjö *et al.*, 2020). Krause *et al.* (2015), observed that such initiatives have shown positive results in increasing youth participation in agriculture.

The Sokoine University Graduate Entrepreneurs Cooperative (SUGECO) is one of the programmes supporting agribusiness among the youth in Tanzania. The programme mainly targets university graduates and supports them to start agribusiness ventures by providing entrepreneurial training, mentorship, and finances to set up their agribusinesses. Through this initiative many young entrepreneurs have been able to create sustainable agricultural enterprises (Donge & Urassa, 2021). Through these incubation programs, remarkable success in the establishment of youth-led agribusinesses has been observed, by building business and entrepreneurial skills, fostering innovation, and promoting value-chain integration in the sector (Adeyanju *et al.*, 2021; Thiong'o & Baba, 2019).

2.3 Tomato production in Tanzania

Tanzania is one of the leading horticulture-producing countries in SSA. The main horticulture-growing regions in Tanzania are the northern region (Arusha, Kilimanjaro and Tanga) and the southern region (Mbeya and Iringa). The agro-climatic conditions and well-established infrastructure favour these regions. The main horticultural products produced in Tanzania are tropical, subtropical, and temperate fruits and vegetables. However, for this review, the focus is on tomatoes. The current production of tomatoes is 463,964.74 tonnes, covering an area of 26,612 ha, as documented in recent estimates (Mutayoba, 2018). Regions in Tanzania that are leading in tomato production are Morogoro (6,519 ha), Iringa (3,274ha),

and Zanzibar (2,370 ha). The bulk of fresh-produced tomatoes in Tanzania is under small-scale farming, with most relying on rainfed farming and a few farmers practising irrigation.

Youth engagement in horticultural production, particularly tomato farming, has steadily increased in Tanzania due to various socio-economic factors and supportive agricultural initiatives. Tomato production presents a viable income-generating activity for youth, largely because of its high market value, strong local and regional demand, and short production cycle, which enables quick returns on investment. In places such as Mvomero District, tomato farming has been widely embraced proving to be a viable agricultural activity for the youth (Mwatawala *et al.*, 2019).

Tomato production is most preferred by the youth due to favourable climatic conditions and arable land in Morogoro region (Edson & Akyoo, 2020). In addition, the Horticultural Development Council of Tanzania (HODECT) has actively promoted and supported the production of horticultural crops through the provision of extension services, training, market linkages and advocating for issues affecting farmers in the region (Kissoly *et al.*, 2017). Through their activities young farmers have acquired skills and knowledge to nurture and expand their agribusiness activities.

With the rise of urbanization, towns and cities are a market outlet for farm produce and especially groceries. In agriculture, access to markets is a key determinant whether farmers breakeven, make profits or their investment goes to waste. Well organized, strong market linkages and good infrastructure are a motivating factor for farmers to commercialize their tomato production (Derbe *et al.*, 2024). Additionally, access to market information and knowledge of inputs and output prices, allow farmers make timely decisions and investment in farm production (Mwatawala *et al.*, 2019). Training of youth in value addition and key aspects of agribusiness also enhances the ability of youth to participate in high-end markets (Boye *et al.*, 2024). Hence, supporting the youth to become credit-worthy through trainings in business record keeping, financial literacy and how to navigate the credit the credit system would ultimately improve their farm investments and production Bonnke *et al.* (2022).

2.4 Agricultural credit/finance programs targeting farmers

Supporting smallholder farmers to access credit is vital to empowering them to unlock their potential in agriculture. Chen *et al.* (2017) reviewed various lending models employed by organizations supporting smallholder farmers. They include the following, Juhudi Kilimo

(operating in Kenya), BRAC based in Bangladesh and One Acre Fund (currently known as Tupande) operating in Kenya, Rwanda, Tanzania and Burundi.

Juhudi Kilimo, a microfinance company in Kenya, serves more than 20,000 smallholder farmers and provides loans which enable farmers to purchase assets that will provide immediate and continuous cash flow, such as irrigation equipment and dairy cows. The loans are co-guaranteed by other group members, and the loan officers ensure that clients purchase high-quality livestock and use the best practices (Chen *et al.*, 2017).

In Bangladesh, BRAC provides credit and savings services to over four million smallholder farmers. They also offer services through a group guarantor scheme that allows farmers to access seasonal and annual loans, quality inputs and market linkages through separate entities within BRAC. In this way, BRAC connects farmers with various value chain actors and strengthening their participation in them.

One Acre Fund, recently renamed *Tupande*, serves over 280,000 smallholder farmers in Kenya, Tanzania, Rwanda and Burundi. The organization offers loans through a group liability scheme with a flexible repayment schedule that puts into consideration the seasonality of farmers income. Additionally, they offer farmer training, market linkages, and access to quality inputs (seed and fertilizer) which are delivered to the nearest town centres close to the farmers.

Digital financial services have changed the landscape for traditional borrowing and requirements. Mobile banking platforms, such as M-Pesa and Tigo Pesa, facilitate access to micro-loans and savings products and allow youth to invest in agricultural production and related services. With the mobile-based credit scoring systems, young farmers can access credit without traditional collateral by using their mobile transaction histories as a form of creditworthiness (Magesa *et al.*, 2014).

2.5 Perceptions of credit access among youth in agriculture in Tanzania

Kisaka (2018) describes perception as the process of selecting, organizing, and interpreting sensations into a meaningful whole. In her study, Kisaka (2018) further described the process as when an individual is exposed to motivation either deliberately or accidentally. In the end, the individual gives attention to the trigger and responds appropriately. Hence, an individual's perception of credit is what will determine their interest and uptake.

Various factors influence the perceptions of youth on the acquisition of loans from financial institutions. The youth perceive the need for collateral as a restraining factor

(Chami, 2018). Many young Tanzanians lack assets to secure loans and have limited credit-borrowing history, to access their credit-worthiness for formal credit. This further reduces their probability of youth accessing formal credit, particularly in rural and semi-urban settings (Kundy & Shah, 2024). To enlighten the youth on available financing packages and requirements, financial literacy is crucial (Mwombeki & Magwana, 2023).

Another factor is the complex bureaucracy involved. Njeru *et al.* (2015) noted that the lengthy and often perceived as lengthy application procedures, deter youth from seeking credit from formal institutions. The process is often perceived as lengthy, complex and time consuming. Khan *et al.* (2024) highlighted that the high interest rates charges on loans could in some cases instil fear in youth, who investing in various enterprises are uncertain of the market fluctuations and variabilities. As a result, of these uncertainties, young people are reluctant in applying for credit. Farming and agricultural activities are also perceived as high-risk enterprises by financial institutions, making them less attractive (Mwonge & Naho, 2022).

Digital financing services, known for their fast and easily accessible services, have limited to no bureaucracy has revolutionized the financial sector. The youth are positive about the arrangement which provide ease of access to loan products and packages that suit them. Mobile banking platforms such as Mpesa and Tigo are flexible and simple to access, making them youth-friendly compared to traditional banking services (Magesa *et al.*, 2014). Hence, providing youth with targeted financial services is more beneficial to them and their farm enterprises (Stanslaus & Mmari, 2021).

Donor-funded initiatives also contribute to enlightening and providing financial support to young people. Through provision of financial and technical support, trainings and market linkages young farmers stand a chance to establish viable agribusiness enterprises (Afande *et al.*, 2015).

In a study to determine farmers' perceptions towards agricultural credit in District Cooperative Bank, Gupta and Agrawal (2018) found that farmers were dissatisfied with the late disbursement of credit, lots of documentation and inadequate information about the loan procedure. To analyse the perceptions of youth on loans issued by the Bank of Agriculture (BOA) in Nigeria, Ayanda and Ogunsekan (2012), established that attractive loan products for the educated elites were tailor-made to suit their respective income streams. The loan facilities from BOA served as capital for the farmers and was invested, creating employment

for several youth in the rural areas. One challenge, was the high interest rates charged by the banks that was difficult for the ordinary farmers to repay due to low farm output.

Chowdhury *et al.* (2018) used the Exploratory Factor Analysis (EFA) to study women entrepreneurs' perceptions of bank credit. The results of the study showed that the reluctance of the women entrepreneurs' to acquire loans resulted from their challenges such as collateral requirements and the strict terms and conditions by banks for loan acquisition. From the study, it was suggested that commercial banks should consider financing women entrepreneurs. Kisaka (2018) used the exploratory factor analysis (EFA) in a survey to study how consumers perceived the edible winged termites in Kimilili sub-county. From the study, it was found that local consumers were positive about the edible termites and enjoyed them as food, easily available at no cost and fits well with their culture. Choi *et al.* (2013) employed the exploratory factor analysis to determine how consumers of street food were aware of risks and benefits posed.

2.6 Determinants of access to agricultural credit by small-scale youth tomato farmers in Mvomero district, Tanzania

In this section the factors that influence utilization of agricultural credit by smallholders, and the models used in data analysis are discussed.

Anang *et al.* (2015) used the Heckman sample selection method to assess the likelihood of smallholder farmers receiving loans and the amount received. The findings from the research highlighted key factors that were influential in receiving credit were gender of the applicant, income of the household, use of technology, geographical location, and availability of a lending facility. The study revealed that uptake of credit by the farmers was relatively low as only 40 percent of the respondents had received loans. Additionally, it was noted that whereas women had a higher chance of receiving credit, men got larger loans.

To assess the factors that determine the capability of farmers to access loans, Owusu (2017) used the logistic regression model. the results of the study indicated that factors that played a significant role in smallholder farmers accessing loans were gender, frequency of extension services, farming experience and proximity to a lending institution. However, group membership and the marital status did not affect the respondents' ability to receive credit.

Sebatta *et al.* (2014) analysed the factors that were considered by lending institutions before issue credit in Zambia. The authors applied the double hurdle model and found that

age, savings, years of formal schooling, amount of time required to pay back the loan, household size and availability of financial lending facilities affected credit accessibility to farmers. Sebatta *et al.* (2014) further found that when cheaper loans with longer repayment periods were more beneficial to farmers as it would allow them to invest and get incomes that would sustain them over a prolonged period. From the study they concluded that expansion and establishment of loan services to rural settlements is one way of empowering smallholder farmers. Additionally, through the formation of savings and credit groups, members can access loan services from amongst themselves at low rates (Sebatta *et al.*, 2014).

The probit model was used by Ibrahim and Aliero (2012) to assess the factors that influenced the borrowing behaviour of small-scale farmers in Nigeria. Factors that were positive in the uptake of credit were age, years of formal education, income, marital status and collateral. Additionally, the interest rate and high transaction costs hindered farmers from accessing credit. Ibrahim and Aliero (2012) also found out that most of the rural farmers did not take loans from banks and proposed that farmers should be in groups to make it easier for them to access such services.

Ololade and Olagunju (2013) used the binomial logit regression to identify factors influencing how farmers take up agricultural credit by farmers in the rural areas of Oyo State, Nigeria. The results of the research show that assets used as collateral and social capital (guarantors) are important when seeking credit from formal sources. However, in the study, Ololade and Olagunju (2013) noted that among the factors that hindered smallholder farmers were high interest rates and short payback periods. The findings show that one of the factors that was significant was marital status, although it negatively affected acquisition of credit from formal institutions. Additionally, unmarried smallholder heads of household had a lower chance of acquiring credit. This is contrary to the case of male household heads who had a higher chance of acquiring formal credit than the females. Ayomide *et al.* (2022), also found that collateral and guarantors played a crucial role in credit access. Hence, Ololade and Olagunju (2013) recommended that smallholder farmers form a cooperative group to pool resources and allow easy access to financing from formal credit institutions.

A study done by Awotide *et al.* (2015) to explore factors influencing credit access among smallholder cassava farmers in Nigeria showed that the number of tropical livestock units, access to credit-related information, household adult members, and farm size owned by the household had a positive and significant effect on the ability of the household head to access

credit. In South Africa, Chauke *et al.* (2013) employed a binary regression model to explore drivers of access to financial credit among smallholder farmers. In the findings, Chauke *et al.* (2013) found that access to credit-related information through extension service providers played a crucial role in smallholder farmers' access to credit. However, attitude towards risk, the length of the payback period, lending requirements and procedures, and the value of assets negatively affected the uptake of credit by smallholder farmers from formal institutions.

Kosgey (2013) in a study on agricultural credit access by grain growers in Uasin-Gishu County, Kenya, opined that financial institutions favoured male farmers than female farmers in advancing agricultural credit. Farmers with more years in grain cultivation were also more likely to access agricultural credit than farmers with lesser years of farming as they were deemed trustworthy and responsible (Kosgey, 2013). Gakuu *et al.* (2014) in a study on the factors influencing access to credit services by women entrepreneurs in Kenya found out that collateral and awareness of lending institutions and opportunities increased the likelihood of accessing credit.

In a study to identify the determinants of formal agricultural credit allocation to the farm sector by arable crop farmers in Benue State, Nigeria, (Oboh & Ekpebu, 2011) found that the factors that significantly affected the rate of credit allocation were farmers' age, educational level, farm and household size. Important to note from the study is that the amount of loan that the borrowers received was lower than what had been requested. Once received, a large portion of the loan was used for other non-farm activities. Oboh & Ekpebu (2011) also noted that beneficiaries with high loan size tended to allocate more of their loans to the farm than beneficiaries with low loan size.

Djoumessi *et al.* (2018) in a study on the determinants of smallholder vegetable farmers credit access and demand in Southwest region, Cameroon used the Cragg's double-hurdle model. The results indicated that years of education, availability of extension services, proximity to the lending institution, membership to a farmers' group or association positively affected access to credit by farmers. The amount of credit borrowed was determined by farmers' proximity to lending facilities, membership in groups and associations, size of land and access to extension services. To encourage the uptake of credit by farmers, the government should incentivize microfinance and lending institutions to set up in rural centres and farmers to join farmer groups and associations.

2.7 Effect of credit on income among young tomato farmers

The availability of credit among the farming community is crucial for agricultural production, and especially during peak periods such as planting, weeding and harvesting. In Nigeria, Owusu (2017) did a study to analyse how cassava farmers who had received loans for their farm activities performed. The propensity score matching (PSM) techniques was used and the results showed the productivity was greatly improved. He further observed that when farmers are supported to get loans to facilitate their production activities, the overall productivity increases. From the findings, it was also noted that most of the farmers in the area were not informed of the existence of the financial institution in the area and had not utilized their services.

In Kenya, Nzomo and Muturi did a study to found out the credit options that were available to small scale farmers. From their findings, it was evident that farmers who had received loans had a 33 percent increase in their productivity. This increase was attributed to the use of certified and quality inputs, greater use of technology and timely farm operations.

Ekwere and Edem (2014) in their research on the effect of key factors of production on output employed the multiple regression analysis. The findings showed that the factors identified (farm size, quantity of inputs and loan amount) influenced 59.2% of the output. Additionally, when the amount of loan was increased, the usage of other factors such as land cultivated, fertilizers and agrochemicals increased, resulting to a 50.7% increase in output. The research concluded that when farmers utilize agricultural credit their production increases. Additionally, the study found that timely disbursement of loans allows for effective implementation of planned farm activities.

In Nigeria, Awotide *et al.* (2015) did a study to explore how the productivity of smallholder farmers growing cassava would be affected when they received credit to support their farming operations. For this study, the endogenous switching regression model was used and the findings of the study revealed that the variables, farm size and the number of livestock a farmer had, negatively affected farm productivity among those who had received the loans. However, the variables that were significant in determining the level of productivity among farmers who did not receive the loans were assets, land size and the size of the household. In conclusion, the study found that when farmers received loans, their productivity increased significantly. Hence, development partners and donors seeking to support farmers should include sustainable financing components in their program activities.

Oladejo (2015) conducted a study in the Osun State of Nigeria to review how the efficiency among tomato traders was impacted by their access to loans. In the analysis of the data, the logistic regression model was used. From the pool of respondents only 37.5% had received credit. Further analysis showed that the challenges that hindered marketers in the tomato value chain from getting credit include high transport and transactional costs. Furthermore, it was noted that the market efficiency of tomato marketers positively affects the quantities of tomato sold per week by the respondents. Based on the findings, the authors recommended that tomato marketers form cooperative groups to address their transportation and financial needs.

Duy (2015) in a study to analyse how rice production among rural households was affected by utilizing loans from formal and informal sources, applied the stochastic frontier analysis and also the quantile regression. The results of the study showed that overall rice production was determined by the technologies that were employed in production, years of formal education, farm size, and the accessibility of credit. In general, the use of formal credit to fund farm operations resulted in greater production efficiency than when informal credit was used. Duy (2015) also noted that borrowers were wealthier than non-borrowers. This is in spite of the fact that small-scale farmers with lower incomes and resources also had their productions level increase significantly when they utilized credit. A recommendation from the study was that more lending institutions should be established in rural areas to improve rice production.

To find out how access to agricultural loans affected production and income among rural dwellers in China, Dong *et al.* (2010) applied the endogenous switching regression model. From the study, Dong *et al.* (2010) found that, savings by the credit-constrained households enabled them to improve their farm productivity. The authors suggested addressing factors that hinder the accessibility of credit among farmers to enhance the full employment resources and the farmers' full potential. However, Reyes *et al.* (2012) study on how the utilization of credit in the cultivation of fruits and vegetables in Chile found that most credit-constrained farmers are quantity rationed and can separate production and consumption decisions. As a result, optimal input levels are utilized, ensuring that the productivity on the farm is not affected. Even though the farmers felt credit constrained, the authors argued that this was not a limiting factor in farm productivity.

2.8 Theoretical framework

This study draws from three interrelated theories: information asymmetry theory, credit rationing theory, and social capital theory. The theories describe how institutional and structural factors influence access to credit. The information asymmetry theory explains how unequal access to information regarding transactions between borrowers and lenders affects credit access (Akerlof, 1970; Bergh *et al.*, 2019). The credit rationing theory argues that lenders cap the loans limit, not because of market failure, but in response to the perceived risk of borrowers as a result of imperfect information (Stiglitz & Weiss, 1981). The social capital theory details how trust and social networks influence credit access (Claridge, 2018; Tsounis & Xanthopoulou, 2024).

The information asymmetry theory argues that when two parties transacting do not have the same level of information, the outcome tends to be inefficient. The theory, first introduced in 1970 by Akerlof through the famous 'market for lemons' model illustrates how sellers privy to certain information can lead to market distortions. Borrowers know more about their financial habits, intentions and risks than financial institutions. As a result, lenders face difficulty assessing borrowers leading to adverse selection and moral hazardous behaviour. Adverse selection is when high risk borrowers seek for loans more, whereas moral hazard sets in after borrowers receive their money and change their behaviour and spending patterns.

The credit rationing theory explains how lending institutions influence availability of credit under uncertain conditions. Stiglitz and Weiss (1981) argue that raising interest rates is not often a solution to regulate loan demand, as it lowers the quality of the borrower pool. High interest rates tend to attract risky borrowers who may explore even riskier ventures once they receive the funds. Instead of raising the interest rates, lending institutions ration credit to even willing and credit worthy borrowers resulting in an equilibrium where, demand for credit is more than supply available.

Social capital theory argues that individuals and communities find value from their relationships, that is, culture, norms, trust and social networks. These connections make it easier to get information and makes compliance easier through the binding social norms. Tsounis and Xanthopoulou (2024) note that social capital functions as a form of collateral, especially where formal financial institutions are weak or distant. In such cases, networks formed based on trust can either work as substitutes for or alongside formal lending

institutions. These networks reinforce peer accountability, creditworthiness, and sharing of resources among group members.

2.9 Conceptual framework

This research study aimed to analyse the factors that affect the access to credit by smallholder farmers' and the effect it has on income in Mvomero district.

The conceptual framework, shown in Figure 2:1 describes the interconnection between access to credit, factors influencing access to credit, and the effect on farm income.

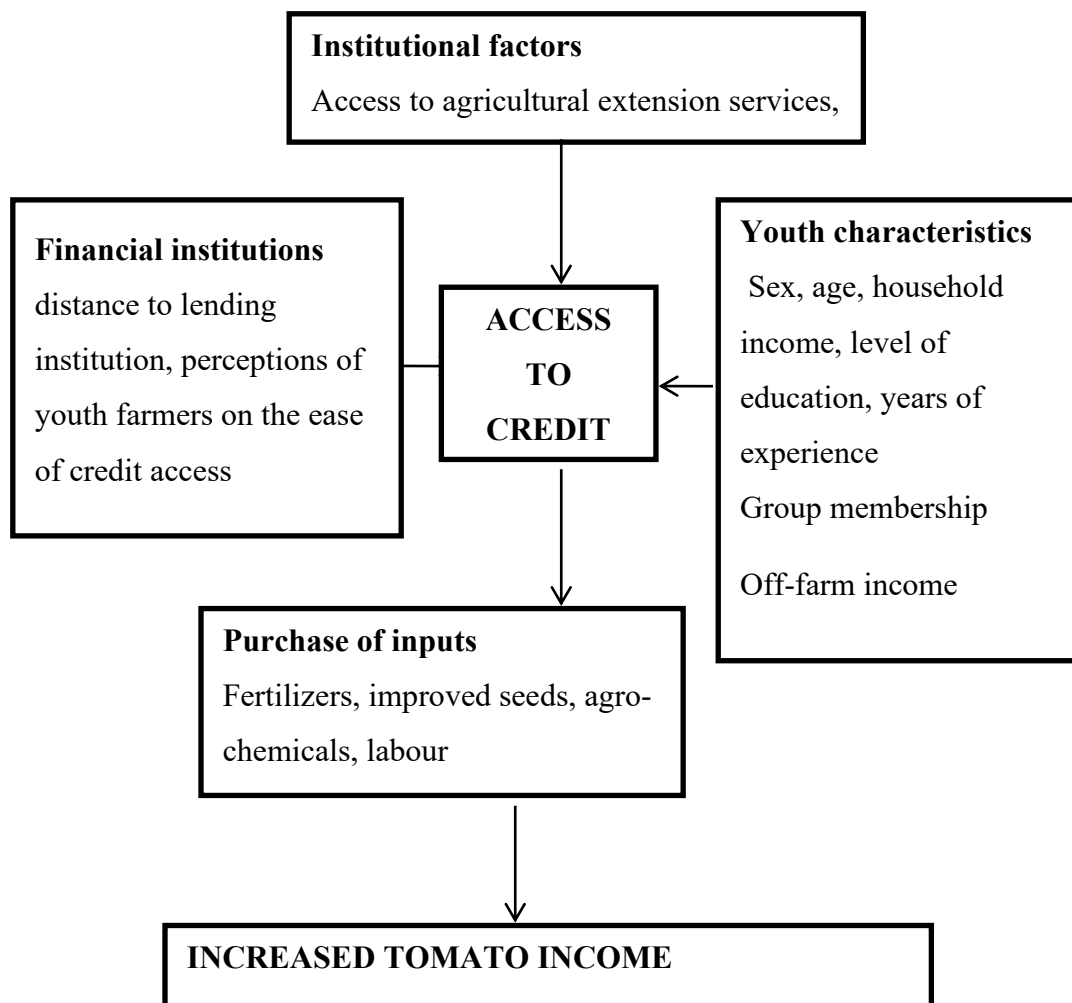


Figure 2:1 Conceptual framework

The socio-demographic factors reviewed were age, farming experience, size of the farm, household size, household income, gender, and years of education. These factors reflect the household's capacity to meet the formal credit institutions' selection criteria. When a farmer is

faced with the decision as to whether or not to apply for credit, how they perceive the process of loan application and their willingness to take the risk will determine the final outcome. The government provides the legal framework for interest rates charged by lending facilities. Additionally, financial institutions have lending policies, such as borrowing requirements determining loan size, scope, and coverage. The financial institutions also determine the creditworthiness of a client and the loan size. Some of the factors that make loans less attractive to resource-constrained households are high interest rates or high collateral requirements.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study area

This research study was conducted in Mvomero district which is one of the six districts in Morogoro region in Tanzania. Bordering Mvomero district to the north is Tanga region and Morogoro rural and Morogoro urban districts to the east and southeast respectively. Pwani region borders to the northwest and Kilosa district on the west. Figure 3:1 shows the map of Mvomero district, whereby the study areas are shown by the shaded region.

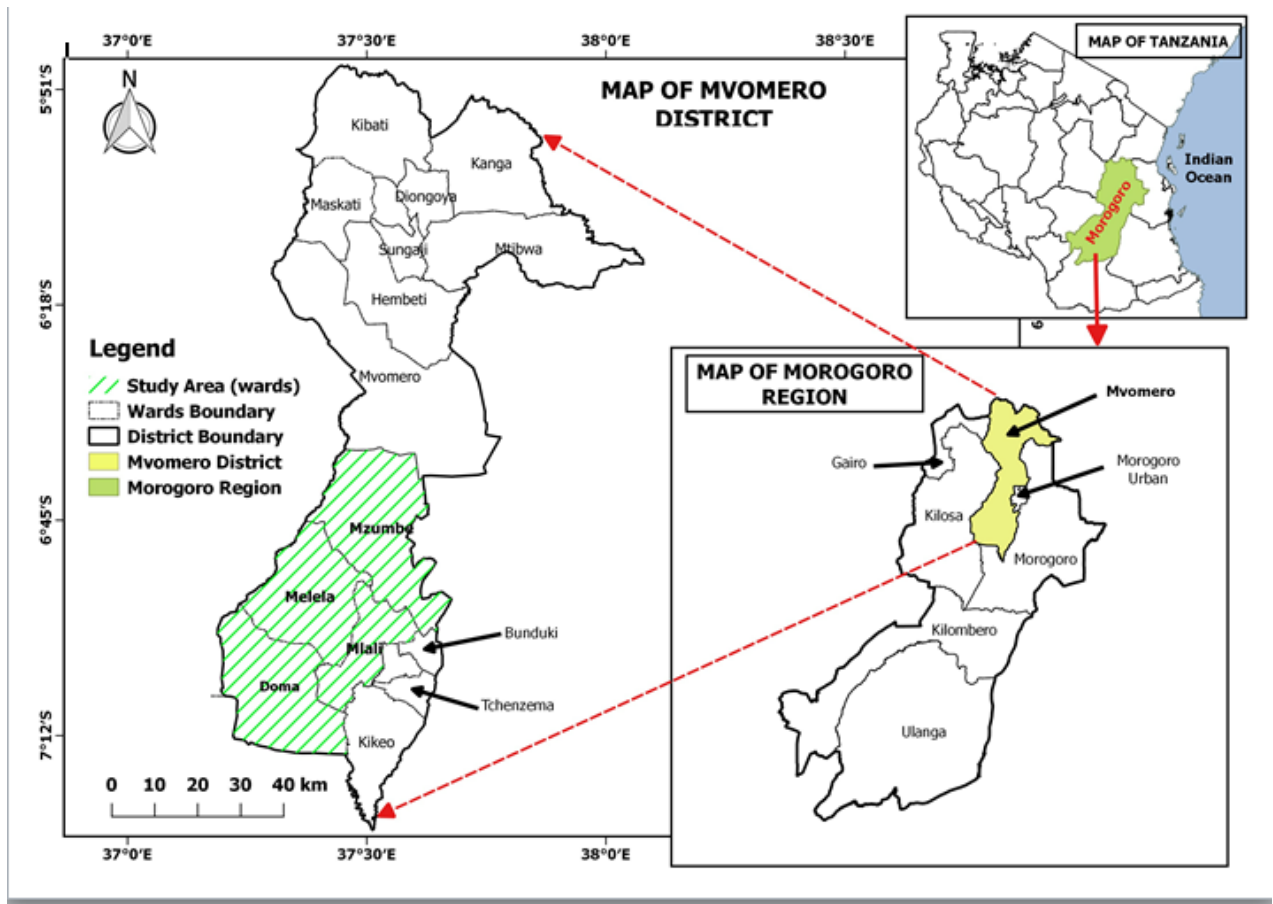


Figure 3:1 Map of study area

Source: Humanitarian Data Exchange 2018

Mvomero district occupies an area of 7,325 km². However, the portion of arable land is approximately 549,375 hectares of the total area. The cultivated area is 247,219 hectares, which amounts to 45% of the area. Land suitable for livestock keeping is 266,400 hectares (URT, 2013). The location of Mvomero district is at an altitude of between 380 – 1,520 meters above sea level which is ideal for cultivating tropical and subtropical crops. Bimodal rainfall is received in the district, with maximum rainfall in April and December. The months

of May through to October are largely dry. The average monthly rainfall received is 106mm with an annual average of 1270mm (URT, 2013).

The major income generating activity in Mvomero district is agriculture, and this provides employment to more than 90% of the population. Other economic activities which the residents engage in include fishing, mining and quarrying. Some of the main crops include maize, cassava, sugarcane, sorghum and paddy. Other crops include vegetables, sugarcane, oil crops, coffee, cotton, beans, millet, peas, potatoes, groundnuts, citrus fruits, mangoes, jackfruits, coconut, tomato, and eggplants. (Gulamiwa, 2015).

Mvomero district is largely comprised of smallholder farmers who make a living from agriculture and especially horticulture. The factors discussed above informed the selection of Mvomero district in addition to the fact that most of its areas are accessible and the population is heterogeneous.

3.2 Sample size determination

For this study Cochran's formula was used to determine the sample size since the population is large and the variability proportion is not known.

$$n_0 = \frac{z^2 pq}{e^2} \quad (\text{Cochran, 1977}) \quad (3.1)$$

Where:

n_0 is the sample size,

z is the selected critical value of desired confidence level,

p is the estimated proportion of an attribute that is present in the population, q

$p = 1-p$

e is the desired level of precision

Since the degree of variability in the population is not known, a maximum variability equal to 50% ($p = 0.5$) and a 96% confidence level with $\pm 5\%$ precision is taken. The calculation for required sample size will be as follows:

$p = 0.5$ and hence $q = 1 - 0.5 = 0.5$; $e = 0.04$; $z = 2.051$

$$\text{Therefore, } n_0 = \frac{(2.051)^2 (0.5)(0.5)}{(0.04)^2} = 657 \quad (3.2)$$

A sample of 657 was expected to be taken from the youth population in Mvomero district. However, due to time and financial constraints, 562 youth farmers were interviewed.

3.3 Data collection method

The study was sponsored the International Institute for Tropical Agriculture (IITA) through a project titled, “Enhancing Capacity to Apply Research Evidence (CARE)” in 2019 that targeted supported research fellows and aimed at supporting the engagement of youth in agribusiness and their contribution to rural economies in Africa. The objective of the project was to empower youth residing in rural areas to embrace agribusiness. This is through evidence-based research and the design of youth-friendly and inclusive policies for the development of rural economies.

3.4 Sampling procedure

For this study, a dataset of 562 respondents was used. First respondents were selected and the multi-stage sampling method was used. Secondly, the target district was selected. In this case, Mvomero district widely known for production of horticultural crop such as tomatoes, carrots, vegetables, eggplants, and fruits was chosen. In the third stage, four wards were selected that had high production of tomatoes Mlali, Doma, Mzumbe, and Melela wards were purposively selected using this criterion. In the fourth stage, all the villages were listed, and later only two villages were selected per ward, which resulted in 8 villages in total. The fifth stage listed all the young farmers in tomato production within the study regions. Finally, the simple random sampling technique was applied to select respondents who were interviewed from the larger list.

To test the interview tool, an initial pool of 56 respondents was involved in a pilot study. Later on, data were collected by trained enumerators who did face-to-face interviews with the selected farmers. Data collected was on demographic characteristics, farm-related characteristics, tomato production, and institutional factors. Table 3:1 presents information on the distribution of respondents in the study area.

Table 3:1 Distribution of respondents in the study area

S/N	Ward	Male	Female	Total	Percentage%	Sample Size
1.	Mzumbe	9,264	9,792	19,056	28.5	160
2.	Mlali	11,470	11,850	23,320	34.8	196
3.	Doma	6,580	6,461	13,041	19.4	109
4.	Melela	5,776	5,742	11,518	17.2	97
	Total	33,090	33,845	66,935	100	562

3.5 Analytical framework

To analyse the data collected, descriptive and inferential methods were used. STATA 14 software was used in data management and analysing. The specific analytical approach for each objective is explained in the sub-sections below.

3.5.1 *Objective 1: To determine the perceptions of small-scale youth tomato farmers in Mvomero district on ease of access to agricultural credit*

To analyse the perceptions of youth farmers about the process of applying for loans and the steps involved, a five-point Likert scale was used. On the questionnaire, respondents indicated their extent of agreement with statements relating to loan access. The responses consisted of the following i) strongly agree ii) agree iii) neutral iv) disagree and v) strongly disagree. For analysis the exploratory factor analysis (EFA) was used.

For this model, p denotes the number of variables (X_1, X_2, \dots, X_p), and m the number of underlying factors (F_1, F_2, \dots, F_m) and X_j is the latent factors. Therefore, the model assumed that there are m underlying factors whereby each observed variable is a linear function of these factors together.

$$X_j = a_{j1}F_1 + a_{j2}F_2 + \dots + a_{jm}F_m + e_j \quad (3.3)$$

where $j= 1, 2, \dots, p$

The factor loadings assume a_{j1}, a_{j2}, \dots and a_{jm} , indicating that a_{j1} is the factor loading of the j variable on the first factor, and e_j represents the specific factor. The factor loadings show how much the variable contributes to the factor, whereby the greater the factor loading, the more the contribution of the variable to respective factors (Yong & Pearce, 2013).

3.5.2 *Objective 2: To identify determinants of access to agricultural credit by small-scale young tomato farmers in Mvomero district, Tanzania*

Access to agricultural credit is a binary variable with the option of access to credit or no access to credit, hence the binary logit model was employed. Whereby, the dependent variable is dichotomous, and the independent/predictor variables are a set of socio-economic characteristics. The Maximum Likelihood Estimation (MLE) is used to predict the probability of a youth tomato farmer accessing credit or not. Equation 3.4 shows the mathematical representation of the binary logit model where, P , denotes the probability of youth farmers accessing credit and predictor variables X_1 to X_{11} .

$$Y = \text{Logit}(P) = \ln\left(\frac{P}{1-P}\right) = \alpha + \beta_1X_1 + \beta_2X_2 + \dots + \beta_{11}X_{11} \quad (3.4)$$

Where P is the probability that a youth farmer accesses credit, $1-P$ is the probability that the youth farmer does not access credit. X_1 is the sex of the farmer (1=male, 0=female); X_2 is the age of the farmer in years; X_3 is marital status (1=married, 0=single); X_4 is the level of education (years of formal schooling); X_5 is the household size; X_6 is the farming experience (in years); X_7 is access to extension services (1=with access, 0=no access); X_8 is group membership (1=yes, 0=No); X_9 is distance to the nearest lending institution (in kilometres); X_{10} is farm size (in acres) and X_{11} is annual income (in Tshs). In the equation 3.3 above $\beta_1, \dots, \beta_{11}$ denote the slope coefficients of the explanatory/predictor variables X_1, \dots, X_{11} , and α is the intercept. Table 3:2 shows the variables used in the binary logit model to identify the determinants of access to credit by small-scale youth farmers.

Table 3:2 Description of variables used in the binary logit regression model

Variable Name	Description	Measurement	Expected Sign
Dependent variable d_i^i	Youth access to credit (1-access to credit, 0-otherwise)	Dummy	
Independent variables			
SEX	Sex of respondent (1-male, 0, otherwise)	Dummy	+
AGE	Age of youth in years	discrete	-
MARST	Marital Status of the respondent (1=married)	Dummy	+
EDUC	Education level (years of schooling)	discrete	+
HHS	Household Size	discrete	-
EXPF	Farming Experience	discrete	+
EXTS	Extension Services	Dummy	+
GRPM	Group Membership	Dummy	+
DIST	Distance to the lending institution in km	Continuous	-
FRMSZ	Farm Size (acres)	Continuous	+
ANNINC	Annual Income (Tshs)	Continuous	+

3.5.3 Objective 3: To estimate the effect of agricultural credit on income among small-scale youth tomato farmers in Mvomero district, Tanzania

This objective evaluated how credit affected income from tomato farming. However, it is usually problematic to estimate an impact using cross-sectional data due to a lack of baseline data hence studies tend to depend on control groups. However, according to Rosenbaum and Rubin (2006), getting a proper match of the treated groups from the control group is challenging. Hence, the estimated results might be biased if this problem is not addressed using good estimation techniques. Most impact evaluation studies have used the Propensity Score Matching (PSM) to resolve this problem; examples of studies that have employed the PSM include (Bello *et al.*, 2020; Bezabeh *et al.*, 2020; Gelgo, 2016; Mulatu *et al.*, 2017; Ogutu *et al.*, 2014; Radeny *et al.*, 2022). Table 3:3 describes the variables used in the PSM model.

Table 3:3 Description of variables used in propensity score matching

Variable name	Description	Measurement	Expected Sign
Dependent Variable			
d_i^i	Income (Tshs)	Continuous	
Independent variables			
SEX	Sex of respondent (1-male, 0, otherwise)	Dummy	+
AGE	Age of youth in years	discrete	-
MARST	Marital Status of the respondent (1=married)	Categorical	+
EDUC	Education level (years of schooling)	discrete	+
HHS	Household Size	discrete	-
OFFINC	Off-farm Income (Tshs)	Continuous	+
EXPF	Farming Experience (years)	discrete	+
DIST	Distance to the lending institution in km	Continuous	-
FRMSZ	Farm Size (acres)	discrete	+

The PSM generates scores for each youth farmer based on observable characteristics. Youth tomato farmers who accessed credit, from here referred to as treatment group, were matched with those who did not access credit, control group. Subsequently, the average difference in income between those who accessed credit and those who did not was estimated and is known as the Average Treatment Effect on the Treated (ATT). The computation of ATT is as illustrated below:

$$ATT = E(Y_{1i} - Y_{0i} | CR_i = 1) \quad (3.5)$$

$$= E(Y_{1i} | CR_i = 1) - E(Y_{0i} | CR_i = 1) \quad (3.6)$$

where, Y_{1i} denotes tomato income from youths who accessed credit, Y_{0i} is income from youths who did not access credit and CR_i refers to the borrowing status of the youths, equals 1 if the youth accessed credit and 0 otherwise. Since an individual (youth tomato farmer) i cannot be observed in both status, that is, with access to credit and without, it is crucial to find a suitable counterfactual from the control group (youth farmers without access to credit).

The probability of accessing credit can be expressed as follows:

$$P(X_i) = Prob(Cr_i = 1 | X_i) = E(Cr_i | X_i) \quad (3.7)$$

The average impact of credit access

$$ATT = E(Y_{1i} - Y_{0i} | P(X_i), CR_i = 1) \quad (3.8)$$

$$= E(Y_{1i} | P(X_i), CR_i = 1) - E(Y_{0i} | P(X_i), CR_i = 1) \quad (3.9)$$

For robustness check, the study adapted three matching methods: Nearest Neighbour Matching (NNM), Kernel-based matching (KBM), Radius Matching (RM). The three matching approaches have been used in previous impact evaluation studies (Bello *et al.*, 2020; Bezabeh *et al.*, 2020; Gelgo, 2016; Mulatu *et al.*, 2017; Ogutu *et al.*, 2014; Radeny *et al.*, 2022). For the Nearest Neighbour Matching, an individual youth tomato farmer is matched to another youth tomato farmer from the control group with close similarity regarding the predicted propensity scores. The Nearest Neighbour Matching method often results in poor matches if the closest neighbours (propensity scores) are far away (Awunyo-Vitor *et al.*, 2014). For the kernel-based matching, farmers in the treated group are all matched with the weighted average in the control group that is inversely proportional to the distance between the propensity scores of the treated and controls group.

Despite the advantages of PSM, use of this approach might be affected selection biased. For this particular study, since credit was not issued to farmers through a random control experiment, instead, youth tomato farmers choose to either borrow credit or not based on

various factors influencing their decision and their ability to qualify for the credit. Hence estimation of impact by comparing the treated versus control group using PSM might inflate or deflate the impact estimates. PSM can correct only selection bias caused by observables but might fail to handle selection biases caused by individual skills and abilities that might enable her/him to access the agricultural loans.

To estimate PSM the two-fold decision of youth tomato farmers' to take up credit was first computed. Dependent on the youth's decision to use credit which is represented by a selection function, S_i , two possible results for the two population units: the first is without treatment (Y_0) and the second is with treatment (Y_1). The framework is as follows:

$$Y_i = (1 - S_i)Y_{0i} + S_iY_{1i}$$

$$Y_i = \begin{cases} Y_{1i} & \text{if } S_i = 1 \\ Y_{0i} & \text{if } S_i = 0 \end{cases} \quad (3.10)$$

The gain from credit use is provided as, $Y_1 - Y_0$.

The behaviour of a youth farmer is described with two outcome equations, accompanied by a selection function determining the regime that each farmer will face (Lokshin and Sajaia, 2011). The credit use by a youth farmer is presented in equation 3.11 below.

$$S_i^* = \tau Z_i + \mu_i \quad \text{with } S_i = \begin{cases} 1 & \text{if } S_i^* > 0 \\ 0 & \text{if } S_i^* \leq 0 \end{cases} \quad (3.11)$$

The vector Z is a representation of various factors that affect the anticipated benefits of receiving credit. The outcome function conditional on the selection is specified as follows:

$$\begin{aligned} \text{Regime 1: } y_{1i} &= \beta_1 X_{1i} + \varepsilon_{1i} & \text{if } S_i = 1 \\ \text{Regime 2: } y_{0i} &= \beta_0 X_{0i} + \varepsilon_{0i} & \text{if } S_i = 0 \end{aligned} \quad (3.12)$$

where Y_{1i} represents the income for credit users and Y_{0i} is the income for non-credit users, and β_1, β_0 and τ are vectors to be estimated. The error terms μ_i in the selection equation and the error terms (ε_{1i} and ε_{0i}) of the outcome equations are assumed to have a trivariate normal distribution with mean zero and covariance matrix defined as follows:

$$\Omega = \begin{pmatrix} \sigma_u^2 & \sigma_{1u} & \sigma_{0u} \\ \sigma_{1u} & \sigma_1^2 & \cdot \\ \sigma_{0u} & \cdot & \sigma_0^2 \end{pmatrix} \quad (3.13)$$

where $\sigma_u^2 = \text{var}(\mu_i)$, $\sigma_1^2 = \text{var}(\varepsilon_1)$, $\sigma_0^2 = \text{var}(\varepsilon_{0i})$, $\sigma_{1u} = \text{cov}(\mu_i, \varepsilon_1)$ and $\sigma_{0u} = \text{var}(\mu_i, \varepsilon_0)$

The study also compares the yield of respondents who received credit from formal sources and respondents who acquired credit from informal credit sources. The expected outcomes are computed as follows:

For youth farmers who used credit:

$$E(y_i|S_i = 1, x_{1i}) = x_{1i}\beta_1 + \sigma_1\rho_1f(\tau Z_i)/F(\tau Z_i) \quad (3.14)$$

For youth farmers who did not receive credit, if they had received credit (counterfactual):

$$E(y_{1i}|S_i = 0, x_{1i}) = (x_{1i}\beta_1 - \sigma_1\rho_1f(\tau Z_i))/(1 - F(\tau Z_i)) \quad (3.15)$$

For farmers who received credit if they opt out from using credit (counterfactual):

$$E(y_{0i}|S_i = 1, x_{0i}) = x_{0i}\beta_1 + \sigma_0\rho_0f(\tau Z_i)/F(\tau Z_i) \quad (3.16)$$

For non-credit users who did not use credit:

$$E(y_{0i}|S_i = 0, x_{0i}) = x_{0i}\beta_1 - \sigma_0\rho_0f(\tau Z_i)/(1 - F(\tau Z_i)) \quad (3.17)$$

The average treatment effect on the treated (ATT) is calculated as the difference between the expected income for agricultural credit users (equation 3.15) and the counterfactual situation if they had not received credit (equation 3.16). The average treatment effect on the untreated (ATU) is calculated as the difference between the income they would have obtained in the counterfactual scenario that they decided to use credit (equation 3.17) and the expected income for farm households who did not use credit (equation 3.15). The conditional expectation equations are also used to calculate heterogeneous effects. Another important statistic is transitional heterogeneity (TH) which measures whether the effect of credit use is larger or smaller for households that used or were non-users in the counterfactual case that they did use, as used by (Tesfaye & Tirivayi, 2018). The computation of the effect of base heterogeneity for households that decided to use credit and for those that did not use credit is shown in Table 3:4.

Table 3:4 Treatment and heterogeneity effects

Sub-samples	Decision stage		Treatment effects
	Credit borrowers	Non-credit borrowers	
Youth farmers who use credit	a) $E(y_i S_i = 1)$	b) $E(y_{0i} S_i = 1)$	ATT
Youth farmers who do not use credit	c) $E(y_{1i} S_i = 0)$	d) $E(y_{0i} S_i = 0)$	ATU
Heterogeneity effects	BH_1	BH_0	TH

Note:

ATT: the average effect of the treatment (credit use) on the treated

ATU: the effect of the treatment on the untreated (non-credit borrowers)

BH_i: the effect of base heterogeneity for households that used credit ($i=1$) and did not use ($i=0$)

TH = ATT – ATU is the transitional heterogeneity

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

The results and discussions of the data analysis are presented in this chapter. First is on how small-scale youth tomato farmers perceive the process of applying for credit and the variables that affect the ability of youth tomato farmers to be issued with credit for farm activities. Finally, is the resultant effect of the income of youth farmers when they invest the finances received into their farm production activities.

4.2 Descriptive results

Table 4:1 shows the results of the socio-economic variables of the youth interviewed, where 562 respondents were interviewed. Out of which 25.60% had accessed credit which they used on tomato crops within the survey period. The results show that from the youth who had accessed credit, 46.53% sourced credit from formal sources like banks, micro-finance institutions and cooperative societies, while the remaining 53.47% had obtained credit from informal sources such as merry go round, social groups, and some from friends and relatives. The respondents reported using the loans on farming, particularly for tomato farming, and part of the money was used for other household and personal needs.

A majority (70%) of the respondents who had received credit were male. The results are probably because of the patriarchal society where the male child inherits family assets and key production resources such as land. These resources serve as security when one is applying for loans from the financial facilities. These findings of this research correspond with those of (Domeher, 2012; Mahasha *et al.*, 2022; Motsoari *et al.*, 2015; Saqib *et al.*, 2016; Zhang *et al.*, 2020). The mean age of respondents who had received credit was 30.68 years while those who had not received was 28.82 years.

Regarding marital status, most (76%) of the respondents who received loans were married. The results could be interpreted to mean respondents who are married have more independence in decision making and have acquired personal assets that they can use as collateral. Of the total respondents, it was found that 7.54 was the mean schooling years. However, for respondents who had received loans, their average was 8.26 years which was higher than that for respondents who had not received any loan support and had an average of 7.06.

Table 4:1 Socio-economic characterization of youth tomato farmers

Variables	With access to credit (n=144)		Without access to credit (n=418)		Pooled (n=562)		t statistic or chi-square
	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev	
Age of the respondent in years	30.68	3.68	28.82	4.41	29.29	4.31	4.55***
Gender of the respondents	0.70	0.46	0.77	0.42	0.76	0.43	3.42*
Marital status of the respondent	0.75	0.43	0.72	0.44	0.74	0.44	0.48*
Education (years of formal schooling)	8.26	3.18	7.06	2.88	7.37	3.07	4.29***
Household size	4.38	1.78	4.08	1.80	4.15	1.80	1.68*
Farming experience in years	5.09	2.91	4.15	1.67	4.39	2.13	3.92***
Annual household income (Tshs)	3,339,580	295,388	3,609,870	203664	3,540,614	169,279	-0.70
Farm size in acres	1.56	0.95	0.88	0.58	1.06	0.75	10.17***
Type of tomato varieties grown (1=local varieties)	0.55	0.50	0.64	0.48	0.61	0.49	1.93
Access to extension services (1=yes)	0.18	0.38	0.14	0.35	0.15	0.36	3.64
Frequency of visits by extension service providers	3.24	1.01	3.25	1.07	3.24	1.05	0.02
Distance to the lending institution in km	3.37	3.89	6.97	11.00	6.04	9.84	-4.18***
Group membership (1=yes)	0.36	0.48	0.05	0.21	0.12	0.33	97.07***

Note 1: *** significant at 1%, and * at 10% 2. Income figures in Tanzania shillings (2298.3 TZS =1 USD). A t-test was used to check for statistical differences between continuous variables, and a chi-square test for categorical variables.

The findings were expected since studies have shown that formal education is a key to empowerment. Literacy enables individual to comply with formal loan requirements and alternative lending platforms (Akpan, 2013; Agbo *et al.*, 2015; Luan & Bauer, 2016; Mitra & Prodhan, 2018).

The overall (pooled) average tomato farming experience was 4.39 years. The young tomato farmers who received loans had tomato farming experience of 5.09 years compared to 4.15 years for those who did not. The difference in farming experience between youth who received loans for use in agriculture and those who had not received was found to be significant at 1% level. The results above were anticipated since farmers who had more years of experience have in the past developed strong social networks which they can use as guarantors to secure loans. These findings collaborate with those of Mwangi and Ouma (2012), Geleta (2014), and Zhao and Li (2021). Average annual household income from tomato farming for household that access credit was slightly lower (TZS. 3,339,580) when compared with respondents without loans from formal sources (TZS. 3,609,870). However, the statistical difference in annual incomes was not significant.

Youth tomato farmers with access to agricultural credit had more land acreage under farming than those without credit. Large farms require more inputs for production, such as labour, agrochemicals, seed, and fertilizers, which necessitates acquiring credit to purchase them. Farm size was also found to be significant at 1% level. The strong association between land size under tomato farming and credit access was expected because land is commonly used as collateral by farmers when applying for credit. Larger land size under farming improves the ability of an individual to get credit for use in farm production (Afari-Sefa *et al.*, 2018).

The average distance to the nearest formal agricultural credit lending institution was 5.96 kilometres. Smallholder youth tomato farmers with access to credit lived approximately 3.05 kilometres from lending institutions, whereas farmers with no access to the loans were, on average, 6.97 kilometres away from lending institutions. The statistical difference in distance to the closest lending institutions by credit access was significant at the 1% level. The results above imply that youth tomato farmers receiving agricultural credit were closer to the formal lending institutions than those who did not access credit. Since most lending institutions are in towns and urban centres, youth tomato rural farmers travel long distances to access credit. The increase in transport costs might have discouraged some of them from seeking credit.

These results confirm those of previous studies showing that geographical distance between lenders and targeted credit beneficiaries affect credit access (Lemessa & Gemechu, 2016; Pedrosa, 2008; Petersen & Rajan, 2002).

Social capital influences the ability of a farmer to receive agricultural credit. In this study, most (36%) of the respondents who received agricultural credit belonged to at least one social group compared to only 5% for those who did not. The statistical differences in group membership, as seen in the two farmer groups was significant at 1% level. This implies that belonging to a social group improved the likelihood of a youth farmer receiving loans. Farmers might take advantage of social groups to borrow money and use it to buy farm inputs and equipment. Additionally, some lending organizations treat group membership as loan security. Membership in a social grouping increased the available pool of guarantors available, as this is a prerequisite when applying for loans from formal institutions. Similar findings by Sedem *et al.* (2016)) showed that membership in a group or association allowed farmers to seek financial assistance collectively from credit institutions. Mdoe and Kinyanjui (2018)) also noted that belonging to a socioeconomic group provided farmers security as financial institutions preferred lending to groups for collective responsibility in loan reimbursement.

4.3 Perception of youth tomato farmers on challenges faced in accessing agricultural credit

The exploratory factor analysis (EFA) was used in this research to analyse how youth farmers perceive the process of applying for agricultural credit. Factor analysis helps reduce data involving several variables into descriptive categories and makes it simpler to focus on key patterns rather than individual variables (Yong & Pearce, 2013). In the study, young farmers indicated how much they agreed with ten perception statements about their view of acquiring credit. The responses from the farmers interviewed were expressed on the Likert scale ranging from strongly agree (5) to strongly disagree (1).

A diagnostic test was performed to determine whether the model was a good fit for the dataset. A Kaiser-Meyer-Olkin (KMO) test result of 0.778 was realized for this study, indicating that the data was a good fit for the method of analysis. As a matter of fact, high KMO values (close to 1) indicate the appropriateness of exploratory factor analysis, whereas values below 0.5 indicate a weak fitting of the factor analysis model (Kinney & Luria, 1980; Watkins, 2018; Williams *et al.*, 2010).

Statements with factor loadings exceeding 0.3 were considered to have loaded sufficiently. Two factors were extracted out of 13 attributes and scored by the respondents regarding challenges associated with access to formal agricultural credit. Two interpretation components were used to get a simpler interpretation of the results: loan requirement and accessibility. The interpretation components (loan requirement and accessibility) were formulated by looking for the loading of the common patterns within the scored attributes. Table 4:2 shows the perceived challenges in accessing loans by farmers and the respective factor loadings on the matrix.

Table 4:2 *Perceived challenges in access to agricultural credit by smallholder tomato farmers in Tanzania*

	Variable	Factor 1	Factor 2	Uniqueness
1	lack the collateral to apply for credit	0.634		0.569
2	Interest rates at financial institutions are high	0.748		0.428
3	The loan application process is tedious	0.745		0.446
4	The loan payback period is short	0.679		0.539
5	I am familiar with the loan application process	0.460		0.580
6	I fear that I may not be able to repay the loan	0.541		0.637
7	Lending institutions are far		0.400	0.720
8	I can easily access loans from lending institutions		0.537	0.698
9	Belonging to a youth group facilitates access to credit		0.478	0.758
10	Access to capital is important to set up agribusinesses		0.488	0.749
11	Access to extension services is important in tomato production		0.624	0.575
12	Timely access to inputs (seed and fertilizer is important for optimum production		0.698	0.471
13	Access to agricultural machinery and technologies improves tomato production		0.678	0.439

The factor loadings were categorized into two attributes. Factor 1 is loan requirements which consist of six statements. Under loan requirements, it is evident that the youth struggle with a lack of collateral to obtain loans, too much bureaucracy, high interest rates, loan

payback period, and the familiarization with the loan application process. Factor 2 loaded seven statements that relate to the ease with which youth farmers access credit. Such factors include belonging to a social group and having lending institutions nearby. Thus, the second categorization, accessibility which indicates the variables that enable the youth farmers to apply and receive credit more easily.

4.4 Determinants of access to credit

4.4.1 Preliminary diagnostics of variables used in the regression model

This sub-section presents variables that determine the ability of youth tomato farmers to get loans for agricultural use. First the possibility of multicollinearity in the explanatory variables was checked before running an econometric model. Table 4:3 presents results of the variance inflation factor.

Table 4:3 Variance inflation factor results for the test of multi-collinearity

Variable	VIF	1/VIF
Age of the youth in years	1.420	0.705
Household size	1.270	0.786
Membership in social groups	1.260	0.794
Experience in tomato farming (in years)	1.250	0.798
Marital status (1=married)	1.190	0.842
Level of education (years of formal education)	1.160	0.861
Gender of the youth (1=male)	1.130	0.883
Land size under tomato crop	1.090	0.916
Annual income from tomato farming	1.080	0.924
Distance to the nearest lending institutions/lender (walking time in minutes)	1.020	0.985
Access to extension services	1.010	0.988
Mean VIF	1.170	

Multicollinearity is a problem that exists when the level of correlation between the explanatory factors is high (Alin, 2010; Kim, 2019). Multicollinearity could result in greater variances, insignificant coefficients, and unstable parameter estimates. The variance inflation factor (VIF) was employed to check for multicollinearity in the covariate variables. Normally, multicollinearity is not an issue if the VIF does not exceed 10. VIF values of 5 and

10 indicate a high correlation between explanatory factors and could result in poor estimates.(Alin, 2010; Kim, 2019). In this case the mean VIF was 1.17 which showed that multicollinearity not existent or of negligible impact.

4.4.2 Factors influencing access to agricultural credit

The logit model was used to assess the factors that were key in determining whether youth farmers took loans for agricultural purposes. Table 4:4 presents results on the determinants of access to agricultural credit.

Table 4:4 Results of the logit model showing the determinants of access to agricultural credit

Variables	Coefficient	SE.	P> z
Dependent variable			
Access to credit (1=yes)			
Independent variables			
Gender (1-male)	-0.343**	0.164	0.037
Marital Status of the respondent (1=married)	0.059	0.081	0.471
Education level of the respondent (schooling years)	0.092***	0.026	0.000
Experience in tomato farming	0.089**	0.037	0.017
Age of the youth in years	0.027	0.019	0.157
Total household members	0.006	0.043	0.889
Land size under tomato farming	0.665***	0.094	0.000
Annual income from tomato farming (ln)	-0.177***	0.064	0.006
Group membership	1.180***	0.213	0.000
Distance to lending institution	-0.041***	0.012	0.001
Access to extension Services (1=yes)	0.150	0.191	0.432
Constant	-0.629	0.980	0.521

Note: *** significant at 1%, ** at 5% and * at 10% (n=557)

The dependent variable is a binary variable, which equals one if a youth tomato farmer accessed credit and zero if they did not. The model has a good fit, as shown by a higher and significant Wald Chi² showing a strong explanatory power of the variables used in the model.

The gender of the youth farmer had a negative influence on the farmers access to loans and was significant at a 5% level. The result implies that male youth tomato farmers were less likely to receive loans than female farmers, whereas females were mostly in groups than

the males. Therefore, this factor increased the chances of female farmers receiving credit over male farmers. The results above are similar to those of Girabi and Mwakaje (2013) and Sedem *et al.* (2016).

The level of a farmer's education was found to be positive and significant at 1%. These results imply that youth tomato farmers with advanced schooling were received loans than farmers with lower levels of education. This finding can be attributed to more knowledge and skills in finance-related issues and the ability to understand loan requirements and seize opportunities. Additionally, educated youth tomato farmers are more knowledgeable and skilled to comprehend the credit application process and to also utilize the loans borrowed. The finding above correspond with those of Elias *et al.* (2015), Etonihu *et al.* (2013), Kiplimo, (2015), Samuel and Asana, (2021) and Saqib *et al.* (2016). Moreover, education increased the young farmers' access to information about the procedures involved in credit borrowing. This result corresponds to Adeyonu *et al.* (2017), who noted that formal education positively impacted the amount of credit awarded to smallholder farmers.

Farming experience significantly and positively influenced credit access at a 1% significance level. Youth tomato farmers who had more years of experience in tomato farming had an increased chance of receiving credit compared to those with fewer years. The result could be attributed to the social networks that the youth tomato farmers had developed over time and therefore used to seek credit. These results above are in harmony to those of (Mukhwami *et al.*, 2020).

Farm size was significant and had a positive effect on the ability of youth farmers to access loans for agricultural production at a 1% significant level. Youth tomato farmers who owned larger farms had an increased chance of accessing credit than those who owned smaller parcels of land. The observation is that farmers who own large farms require more capital to purchase fertilizers, seeds, and agrochemicals and hire machinery and labour to facilitate production. Credit providers preferred farmers with legal ownership of larger pieces of land since the default rates among these farmers are likely to be lower. Land ownership is key to accessing credit from formal sources (Domeher & Abdulai, 2012). Additionally, experience in farming increases smallholder farmers' social capital, which they can use to gain information about formal money lenders and have each other as guarantors. Besides, lending institutions consider land ownership prime collateral; therefore, large farm sizes

mitigated the credit risks, resulting in more credit (Chandio *et al.*, 2017; Sangwan & Nayak, 2021; Ullah *et al.*, 2020).

Belonging to a farmer group membership served as a significant pre-requisite and had a positive coefficient at 1% level. These results suggest that youth tomato farmers who belonged to a group were more likely to receive credit than non-members. These results also imply that group membership increases the chance of receiving agricultural loans. This could be because group members can use each other as guarantors when borrowing money from formal credit sources in case of external credit borrowing. Other studies with similar results are Afari-Sefa *et al.* (2018), Denkyirah *et al.* (2016), Heikkilä *et al.* (2016) Kiplimo, (2015), Mwangi and Ouma (2012) and van Bastelaer (2010). Besides, smallholder farmers can take advantage of social groups to share knowledge and information through social groups. This result conforms with those of Afari-Sefa *et al.* (2018), Kangogo (2013), Satyasai *et al.* (2017) and Sithole *et al.* (2021).

The distance to the nearest formal loan lender had a negative coefficient that was significant at 1% level. The result above suggests that young farmers residing closer to lending institutions have a higher chance of borrowing loans and receiving credit-related information than those in distant areas. The ease with which these farmers could visit lending institutions and receive additional advice on the financing options could explain the finding. The result above is similar to that of Chauke *et al.* (2013), who noted that farmers are more likely to borrow when financial facilities are close to their residences.

Annual income had a negative and significant effect on accessibility of credit at a 5% significant level. From the result it shows that higher incomes served as a disincentive for farmers to seek loans. Empirical evidence from previous studies shows that when youth tomato farmers income grew, they did not take as much loans because they were had enough for themselves (Kiplimo *et al.*, 2015; Kiros & Meshesha, 2022). However, a study in Kenya shows that households that had high incomes were more likely to use that as an opportunity to acquire more loans (Kiplimo, 2015). Supporting the findings of Kiplimo (2015), Luan and Bauer (2016) noted that farmers with higher annual incomes were awarded more money than those with lower annual incomes

4.5 Impact of agricultural credit on net annual income from tomato farming

To analyse the effect of credit use on income among tomato farmers the PSM was applied. A diagnostic test was conducted to determine the suitability of the dataset before implementing PSM.

4.5.1 Diagnostic test for covariates used in PSM matching

4.5.1.1 Test for common support condition

Figure 4:1 shows the density distribution of propensity scores generated and used for the best fit matching technique (Radius Matching technique). The overlap in the dispersal of propensity scores for youth farmers with and without access to credit shows the achievement of the common support condition. These results suggest that the treated group had a proper match from the control group. Hence, this necessitates matching young farmers with similar characteristics from both groups before computing the impact estimates. Matching young farmers (those with and without access to credit) was done in the region of common support to ensure that youth farmers with similar characteristics are matched to avoid biases in the estimated results.

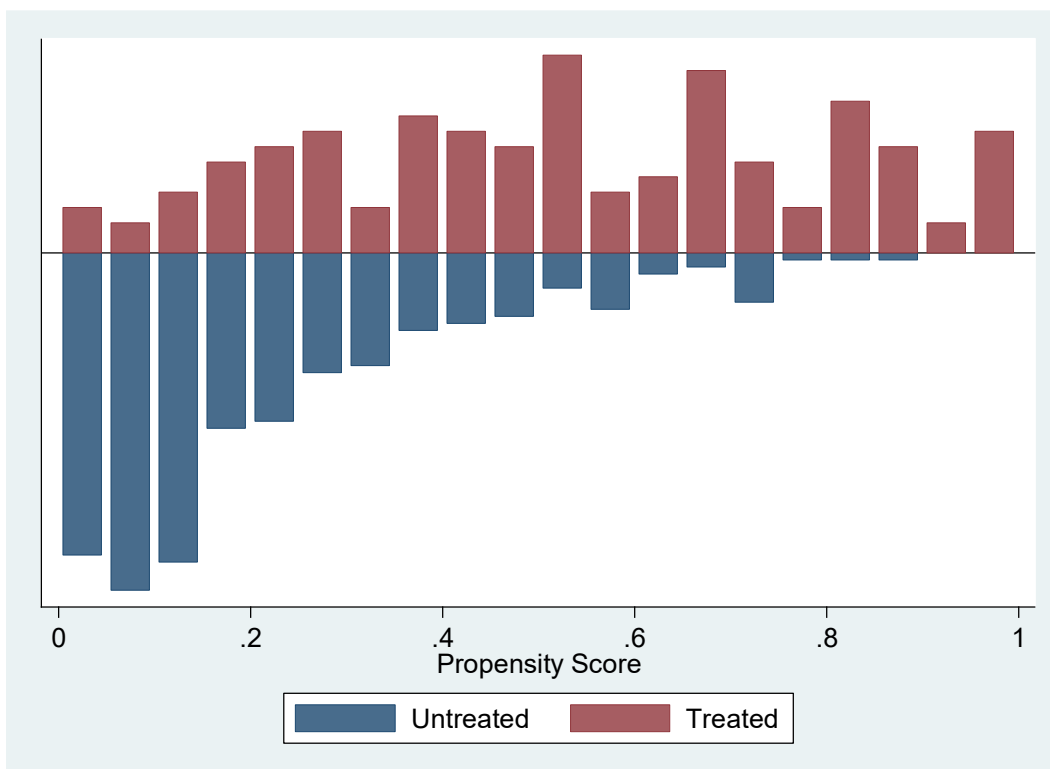


Figure 4:1: Check for balancing in covariates used in PSM, comparison of credit access, those who accessed vs. those who did not access credit

4.5.1.2 Balancing property test

Table 4:5 shows the results of the balancing propensity test.

Table 4:5 Results of covariate balancing tests for propensity score using the radius matching algorithm

1	2	3	4	5	6	7	8
Variables	Sample	Mean		%	%	t-test	
		Treated	Control	Bias	bias reduced	t	p> t
Age	Unmatched	30.685	28.848	45.200		4.480	0.000
	Matched	30.234	29.857	9.300	79.500	0.700	0.487
Education	Unmatched	8.993	7.048	64.100		6.780	0.000
	Matched	8.00	7.996	0.100	99.800	0.010	0.992
Gender	Unmatched	0.699	0.778	-17.900		-1.890	0.059
	Matched	0.670	0.634	8.200	54.200	0.510	0.608
Marital status	Unmatched	0.755	0.732	5.300		0.550	0.585
	Matched	0.734	0.676	13.300	-148.300	0.870	0.386
Farm size	Unmatched	1.548	0.882	85.700		10.010	0.000
	Matched	1.276	1.246	3.800	95.500	0.230	0.818
Household size	Unmatched	4.357	4.082	15.400		1.580	0.115
	Matched	4.298	4.210	4.900	68.100	0.340	0.735
Farming experience	Unmatched	4.983	3.634	56.600		6.730	0.000
	Matched	4.107	4.107	0.000	100.000	0.000	0.999
Distance to the lending institution	Unmatched	3.063	6.964	-47.100		-4.130	0.000
	Matched	3.540	3.521	0.200	99.500	0.030	0.980
Group membership	Unmatched	0.357	0.046	83.800		10.570	0.000
	Matched	0.160	0.176	-4.400	94.800	-0.290	0.768
Log annual income	Unmatched	14.526	14.570	-4.000		-0.410	0.685
	Matched	14.443	14.498	-5.000	-25.600	-0.330	0.738
Extension services	Unmatched	0.196	0.140	14.900		1.590	0.112
	Matched	0.181	0.127	14.400	3.200	1.020	0.308

Source: Field survey IITA Care project, 2019

The balancing test allows for the confirmation whether the variances in the two groups have been eliminated.

From the data analysed the covariates were equally distributed and similar for the two groups. Hence, the control group was considered a plausible counterfactual. As a result of matching, the bias between the groups were significantly reduced as shown in columns 5 and 6. The p-values in column 8 were all insignificant after matching (Abadie & Imbens, 2016; Smith & Todd, 2001), indicating no differences between the treated and control groups with regard to the distribution of covariates.

Table 4:6 presents the summary of the covariates balancing test indicators before and after matching using the PSM method. Summary results on matching indicators show a substantial match between those with access to credit and those without, making them comparable. The value of the Pseudo R² before matching was 0.328, but after matching, there is a substantial drop to 0.009. The p-value of the likelihood ratio test before matching (0.000) is significant. However, after matching, the p-value (0.996) is not significant. The mean standardized bias significantly reduced from 40.0 before matching to 5.8 after matching, with an 84.5% bias reduction.

Table 4:6 Overall matching quality indicators before and after matching using radius matching

Sample	Pseudo R ²	LR chi ²	P>(X ²)	Mean Bias	Bias	% Bias reduction
Unmatched	0.328	208.300	0.000	40.000	146.500	
Matched	0.009	2.440	0.996	5.800	22.700	84.500

4.5.2: Average treatment effect of agricultural credit on household income from tomato farming

Three PSM matching algorithms, Nearest Neighbour Matching, Radius Matching, and Kernel Matching were used to check the effect that credit use has on net income from tomato farming. The results from the matching techniques were all based on the common support condition.

The ATT shows that by using credit, there was a significant positive impact on the net income of youth tomato farmers. Table 4:7 shows that youth tomato farmers with access to

credit had a higher net income from tomato farming compared to those who did not access agricultural credit.

Table 4:7 PSM matching results on the impact of agricultural credit on household net income from tomato farming

Matching Algorithm	With credit access.	Without credit access	Difference	t-statistic
Dependent variable: log net income				
Nearest Neighbour Matching	6,530,063.57	3,376,538.46	3,153,525.10	2.38***
Radius Matching	6,530,063.57	2,912,534.18	3,617,529.39	6.26***
Kernel Matching	6,530,063.57	2,616,214.58	3,913,848.98	3.16***

Note: *** significant at 1%, ** at 5% and * at 10%

Results from the research showed that using agricultural credit positively influenced the income youth tomato farmers earned annually. The differences in annual net income from tomato farming between farmers who received agricultural loans and those did not receive any ranged between 3,153,525.1 and 3,913,848.98 Tanzania shillings. The near neighbour matching technique had the lowest difference in net income, 3,153,525.10 Tanzania shillings, while the kernel matching technique had the largest difference, 3,913,848.98 Tanzania shillings.

These results were similar with those of (Acclassato *et al.*, 2021; Agbodji & Johnson, 2021; Awotide *et al.*, 2015; Diallo *et al.*, 2020; Girabi and Mwakaje, 2013; Khan *et al.*, 2018; Kondal 2020; Owusu, 2017; Kabayiza *et al.*, 2021; Sedem *et al.*, 2016; Sekyi *et al.*, 2020; Taremwa *et al.*, 2021), who noted that agricultural credit significantly improved farm yields, income, and productivity. Results from previous studies noted that agricultural loans allowed farmers to cater for production costs such as land preparation, planting, weeding, irrigation, harvesting, and transportation (Mwonge & Naho, 2022; Osabohien *et al.*, 2022; Peprah *et al.*, 2020; Rashid, 2021). Additionally, credit allows farmers to adopt technologies, purchase farm machineries, inputs (certified seeds, pesticides, herbicides, and fertilizers), and payment for hired labour (Mohamed & Temu, 2008). Therefore, availability of loans for agriculture are crucial for farmers to overcome financial challenges and increase their productivity and income.

Figure 4:2 shows that the common support condition was achieved before employing the PSM matching technique.

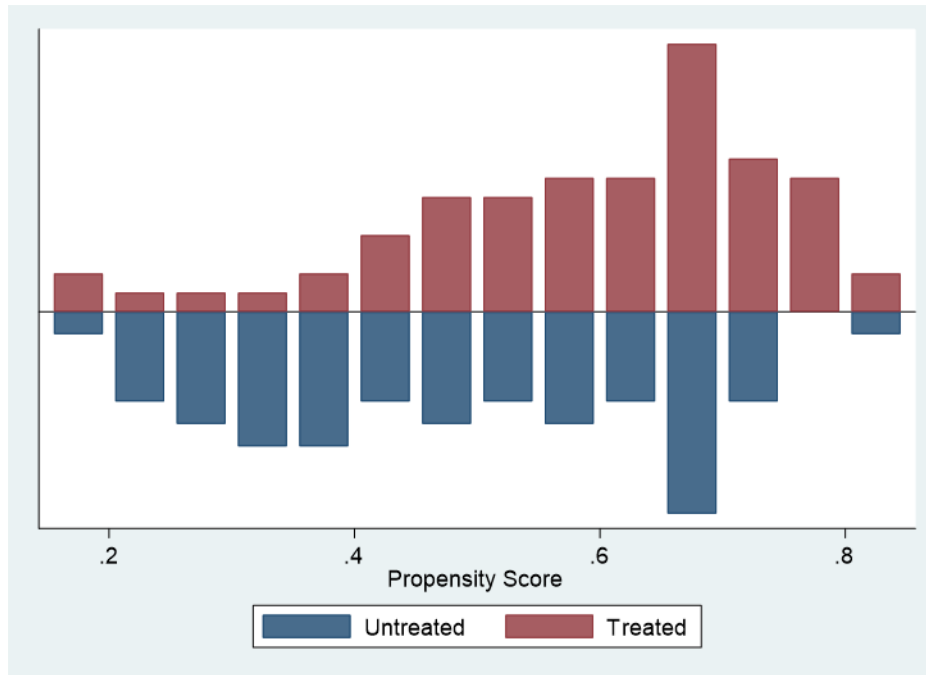


Figure 4:2: Check for balancing in covariates used in PSM during the comparison of credit access by formal vs informal sources

Table 4:8 presents the results that using credit has on net income, considering various credit sources. Here the comparison is made of how income is affected when farmers use loans obtained from formal and informal credit sources. From the results below, youth who got credit from formal sources had more income than youth farmers who obtained income from informal sources.

Table 4:8 Impact of credit on net income from tomatoes, comparison of formal and informal credit sources

Matching Algorithm	Credit from formal sources	Credit from informal sources	Difference	t-statistic
Dependent variable: log net income				
Nearest Neighbour Matching	5,215,945.45	7,067,679.03	-1,851,733.58	1.03***
Radius Matching	5,215,945.45	7,656,450.52	-2,440,505.06	1.13***
Kernel Matching	5,184,720.63	6,808,959.26	-1,624,238.62	1.07***

Note: *** significant at 1%, ** at 5% and * at 10%

The three PSM matching techniques show that the income difference between the two credit sources ranged from 930,585.37 Tanzania shillings to 1,181,824.12 Tanzania shillings. PSM matching methods produced equal net income for farmers who got credit from formal sources, as shown in Table 4:8 but different incomes for the young farmers getting loans from informal sources. The lowest income for those who got credit from informal sources was reported by the Radius matching technique (930,585.37 Tanzania shillings), while the highest income differences were produced by nearest neighbour matching (1,181,824.12 Tanzania shillings). The differences in net income are likely as a result of the reason that an individual can access more stable loans from formal lending institutions than informal ones. The loan they get can be used to purchase quality and sufficient inputs for farming. Hence, this led to high levels of production compared with those who received credit from informal sectors (friends and relatives).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This research study employed the Exploratory Factor Analysis to assess the perception of credit access among small-scale youth tomato farmers in Mvomero District. The results show that although several farmers acknowledged the importance of agricultural loans in improving agricultural productivity, many perceived the process of applying for formal credit as complex. The reason for this, is the need for collateral, low financial literacy on availability of financial packages and their suitability to the farming production cycle, complex application procedures, and high interest rates. On the other hand, most of the farmers got loans from informal sources including friends, relatives and farmer groups. These informal sources provided ease of access, flexibility and minimal documentation, despite the exploitation that may result and the higher interest amounts.

The binary logit regression model was employed to analyse the variables that contributed to one receiving credit for agricultural purposes. Variables were categorized as socioeconomic, farm-related and institutional factors. Factors that showed significant influence are level of education, farming experience, land size, annual income, group membership, and proximity to lending institutions. Further, the results showed that female youth farmers had a higher chance of receiving credit than their male counterparts, potentially due to higher levels of group participation among women, which can facilitate collective loan guarantees. Higher level of education and more years of farming experience also positively influenced the ability of farmers to receive loans. This is likely due to increased financial literacy, awareness of financial products and understanding of the credit-application process. Larger land sizes served as a proxy for collateral, thereby improving eligibility, while group membership facilitated access through social capital and informal risk-sharing mechanisms. Conversely, longer distances to lending institutions and higher annual incomes negatively influenced credit access, with the latter suggesting reduced credit demand among financially self-sufficient farmers.

The third objective assessed the effect of credit access on annual net income of small-scale youth tomato farmers using Propensity Score Matching (PSM). The PSM method used to control for selection bias was used. The results, estimated through Nearest Neighbour Matching, Radius and Kernel Matching techniques, consistently indicated a positive and

statistically significant effect of credit access on household income. Youth farmers who accessed agricultural credit earned considerably higher net incomes from tomato farming compared to their counterparts without credit access. The analysis further showed that youth who obtained credit from formal sources achieved better income outcomes than those relying on informal sources, likely due to the stability, adequacy, and productive investment potential associated with formal credit. These findings align with prior literature that documented that availability of credit enables farmers to overcome liquidity constraints, purchase quality inputs, adopt technologies, and enhance overall farm production.

5.2 Conclusions

Below are the conclusions of the study.

- i. Whereas, small-scale youth tomato farmers in Mvomero district acknowledge the importance of credit in farm production, majority perceive formal credit access as difficult to obtain. This perception is because of stringent collateral requirements, limited awareness of financial products, and complex application processes. Because of this perception, most farmers prefer borrowing from informal sources. This preference for informal sources despite their ease of access and flexibility, limits farmers' ability to secure higher loan amounts to make significant agricultural investments.
- ii. The accessibility of agricultural credit is dependent on socioeconomic, farm-related, and institutional factors. On the specific variables, gender, education, farming experience, land size, group membership, and proximity to lending institutions increased the chances of farmers accessing credit. Female farmers were more likely to access credit, partly due to stronger participation in groups. Conversely, longer distances to lending institutions and higher annual incomes reduced the likelihood of farmers to access to credit.
- iii. Access to agricultural credit among youth farmers has a positive and statistically significant effect on the net annual income. Farmers with access to credit, especially from formal sources, earned higher incomes due to the higher amounts borrowed and the investment made on long term projects and farm activities.

5.3 Recommendations

The recommendations from the study are as follows;

- i. To improve the perception of youth and enhance uptake of formal loan products, financial literacy is crucial to create awareness on the loan application process, the eligibility criteria, and collateral requirement. This requires joint efforts from government agencies, financial institutions, and farmer organizations to provide youth farmers receive useful information and develop trust and confidence in engaging with formal credit systems.
- ii. To accommodate the varied financial preferences of young farmers, youth-friendly loans are required to address the socioeconomic and institutional barriers. Youth should also be encouraged to come together in groups so that they can leverage group-based funds, incentives and grants to support their activities.
- iii. Credit from formal institutions offer more utility and opportunity for investment. To increase uptake of formal credit by youth farmers, loan products should be tailored to accommodate the seasonal farming cycles and complementary training in financial management and best agronomic practices.

5.4 Areas for further research

The following areas are proposed for future research;

- i. Since this study used cross-sectional data, future research could use time series data to track the long-term impact of credit use on income, farm development, and household wellbeing. Further research into gender differences in credit utilization and challenges, as well as comparative studies across different regions, would provide deeper and more inclusive insights for policy development.
- ii. The effect of access to credit can also be studied in relation to other major crops such as maize and rice, which are among the most consumed and cultivated in Tanzania. This would help determine whether credit access influences income and productivity differently across various value chains.
- iii. Future research should explore other variables that influence youth engagement in agriculture beyond credit use, such as land availability, access to agricultural training, and market linkages. These factors may interact with credit access to either enhance or hinder youth participation in farming.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE

This questionnaire was designed to collect data to establish the **Effect of Credit on Tomato Income among Youth Farmers in Mvomero district, Tanzania**. This information will assist policymakers in providing incentives to engage youth in Agribusiness. As a respondent to this research, you are requested to provide information that is true to the best of your knowledge. All information provided will be treated with the utmost confidentiality. Your cooperation is highly appreciated.

Name of enumerator _____

Date _____

Region _____

District _____

Ward _____

Village _____

Select the most appropriate response for each of the following questions.

SECTION A: DEMOGRAPHIC FACTORS

1. Sex
 - a) Male
 - b) Female
2. Age in years _____
3. Marital status
 - a) Single
 - b) Married
 - c) Divorced
 - d) Widowed
 - e) Separated
4. What is the total number of members in your family household? _____
5. How many years of formal education do you have? _____
6. What is your highest level of education?
 - a) College or university
 - b) TVET
 - c) Secondary level

- d) Primary level
- e) No formal schooling

SECTION B: ECONOMIC ACTIVITIES (TOMATO PRODUCTION)

7. Apart from tomato production, what other farm activities are you engaged in?
 - a) Other crops farming
 - b) Livestock farming
8. What are the other sources of income outside farming activities?
 - a) Salaried employment
 - b) Business activities
 - c) Other (specify) _____
9. Approximately how much do you earn annually from your off-farm activities? _____

10. For how many years have you been producing tomatoes? _____
11. What area (in acres) was under tomato production in the 2019 cropping season? _____

12. How many crates of tomatoes did you harvest in the previous cropping season? _____

13. How much (in Tshs) did you sell a crate of tomatoes? _____
14. Please provide information on the costs incurred in tomato production for the previous season.

Item	Unit of measurement	Quantity	Cost per unit	Total cost
Land rent (<i>if applicable</i>)				
Labour cost	Acre			
❖ Land preparation	Tshs/acre			
❖ Planting	Man/days			
❖ Weeding	Man/days			
❖ Harvesting	Man/days			
❖ Transportation	Tshs/acre			
❖ Irrigation	Tshs/acre			
Inputs				
❖ Seeds	5g, 10g, 25g			

❖ Fertilizer	50kg			
❖ Pesticides	Litre			
Others				
Total cost				

SECTION C: INSTITUTIONAL ARRANGEMENT

15. Have you received extension service in the previous growing season?

- a) Yes
- b) No

16. If **YES**, indicate the frequency of visits by extension officers.

- a) Weekly
- b) Every two weeks
- c) Monthly
- d) Quarterly

17. Indicate your satisfaction with the extension services received.

- a) Very satisfied
- b) Satisfied
- c) Neutral
- d) Fairly Satisfied
- e) Not Satisfied

18. Are you a member of any farmers' group?

- a) Yes
- b) No

19. If **YES**, name the group _____

20. Which of the following services does the group offer?

- a) Access to loans
- b) Training on tomato production
- c) Access to markets
- d) Others (specify)_____

21. What is the major source of finances for farm operations?_____

22. a) Did you apply for credit for the 2019 cropping season?

- i. Yes
- ii. No

- b) If **YES**, was the application successful?
- i. Yes
 - ii. No
- c) If the loan application was successful, did you receive the amount borrowed?
- i. Yes, I received the amount borrowed.
 - ii. No, I received less than the amount borrowed.
- d) Indicate the amount received _____
23. What was the interest rate?
24. From the loan acquired, how much was used for agricultural production? _____
-
25. Which of the following reasons explains why you have not applied for a loan?
- a) High-interest rates
 - b) Lack of collateral
 - c) No need for credit
 - d) Lending institutions are far
 - e) The application procedure is complicated
 - f) Unable to repay the loan
 - g) Non-familiarity with the loan application process
 - h) Not eligible for loans from lending institutions
 - i) Others(specify)_____
26. Where did you borrow your credit from?
- a) Formal institutions
 - i. Bank
 - ii. Cooperative society
 - iii. Microfinance institutions
 - b) Informal institutions
 - i. Friends
 - ii. Relatives
 - iii. Local moneylenders
27. Indicate the number of years you have been borrowing from your preferred institution.
- a) 1 year and less

- b) 2 years
- c) 3 years
- d) 4 years
- e) 5 years and above

28. What is the distance (in kilometres) to the lending institution? _____

29. Which of the following inputs was purchased through the loan acquired?

- a) Fertilizers
- b) Improved seed
- c) Pesticides
- d) Hired labour

30. Which of the following non-agricultural activities was financed by the loan?

- a) Business/trade
- b) Food
- c) Children's education
- d) Health/medical expenses
- e) Social obligations such as marriage ceremonies
- f) Others (specify)_____

31. Rate the following statements regarding access to credit. **SA-Strongly agree, A-agree, N-neutral, D-disagree, SD-strongly disagree**

S/N	STATEMENT	SA	A	N	D	SD
i.	I lack the collateral to apply for credit					
ii.	I can easily access credit from lending institutions					
iii.	The interest rates from financial institutions are high					
iv.	The loan application process is tedious					
v.	Youth groups facilitate access to credit					
vi.	The loan payback period is convenient					
vii.	I am familiar with the loan application process					
viii.	I fear that I may be unable to repay loans, thus do not					



	apply.					
ix.	I need credit to invest in agriculture					
x.	The lending institutions (banks, cooperatives, microfinance institutions) are far					

Thank you.

APPENDIX 2: RESEARCH PERMIT

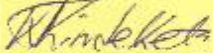
UNITED REPUBLIC OF TANZANIA

**TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY
(COSTECH)**





RESEARCH PERMIT

Permit No.	2020-009- NA-2019-366
Date	3 rd January 2020
Researcher's Name	Chelangai Huldah Too
Nationality	Kenyan
Research Title	Effect of access to credit on youth engagement in tomato production in Morogoro Rural district.
Research Area(s)/Region(s)	Morogoro
Validity	From: 3 rd January 2020 to 2 nd January 2021
Local contact/collaborator (with affiliated institution)	Dr. Victor Manyong, P. O. Box 34441, Dar es Salaam, Tanzania, Cell phone: +255 754 785 122



PROGRAM OFFICER



FOR: DIRECTOR GENERAL

IMPORTANT REQUIREMENTS

- Research permit that involve collecting human, plant or animal materials / data that will be exported outside Tanzania must submit a signed Material Transfer Agreement (MTA), Data Transfer Agreement (DTA) between Tanzania host institution and the foreign counterpart. The MTA/DTA will indicate terms for collecting, storing/managing, transporting, disposal or recycling of the materials/DATA to Tanzania after the closure of the research project.
- Any patent or intellectual property and royalty emanating from any research approved by the National Research Registration Committee (NRRC) shall be owned as stipulated in the research proposals and in accordance with the IP policy of the respective research institutions.
- All researchers are required to report to a Regional Administrative Secretary (RAS) of the study area and present the introduction letter and activity schedule (plan) prior starting any research activity.
- All researchers are required to submit quarterly progress reports and all relevant publications made after completion of the research.
- All communications should be addressed to COSTECH Director General through clearance@costech.or.tz; dr@costech.or.tz or +255222190745; +255 (022) 2771338. Terms and conditions of the permit are found at www.costech.or.tz

APPENDIX 3: STATA RESULTS

Preliminary tests

i. Variance Inflation Factor results

Variable	VIF	1/VIF
age_years	1.42	0.704699
HH_MEMBS	1.27	0.786115
GRP	1.26	0.794066
EXP_TOM	1.25	0.798353
Maritstats	1.19	0.842436
educ_years	1.16	0.860793
Gender	1.13	0.883188
TOM_LAND	1.09	0.916021
L_ANN_INC	1.08	0.923600
DIST_LNDR	1.02	0.984588
EXTNSN	1.01	0.988251
Mean VIF	1.17	

ii. Pstest

Variable	Mean		%bias	t-test		V(T)/ V(C)
	Treated	Control		t	p> t	
GRP	.35664	.17232	49.7	3.60	0.000	.
DIST_LNDR	3.0628	2.7315	4.0	0.62	0.538	0.58*
EXP_TOM	4.9832	3.6225	57.1	4.65	0.000	2.31*
educ_years	8.993	8.0626	30.7	2.70	0.007	1.48*
TOM_LAND	1.5483	1.9353	-49.7	-2.50	0.013	0.35*
Gender	.6993	.57884	27.5	2.13	0.034	.
Maritstats	2.1049	2.1078	-0.3	-0.03	0.977	1.60*
EXTNSN	.1958	.09649	26.6	2.39	0.017	.
L_ANN_INC	14.526	13.959	51.5	3.11	0.002	0.33*
age_years	30.685	29.399	31.7	2.93	0.004	0.99

* if variance ratio outside [0.72; 1.39]

Ps	R2	LR	chi2	p>chi2	MeanBias	MedBias	B	R	%Var
0.101		39.95	0.000		32.9	31.2	76.7*	1.05	86

* if B>25%, R outside [0.5; 2]

Objective 2

Probit regression

Number of obs = 557

LR chi2(11) = 203.26

Prob > chi2 = 0.0000

Pseudo R2 = 0.3203

Log likelihood = -215.64185

LN_APP	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
GRP	1.17974	.2127621	5.54	0.000	.762734	1.596746
DIST_LNDR	-.0409346	.0119404	-3.43	0.001	-.0643373	-.0175318
EXP_TOM	.0886134	.0371736	2.38	0.017	.0157545	.1614724
educ_years	.0923188	.0255749	3.61	0.000	.0421929	.1424447
TOM_LAND	.6645753	.0943718	7.04	0.000	.47961	.8495405
Gender	-.3431719	.1644158	-2.09	0.037	-.665421	-.0209229
Maritstats	.058576	.0813295	0.72	0.471	-.100827	.2179789
EXTNSN	.1500751	.191045	0.79	0.432	-.2243662	.5245164
L_ANN_INC	-.1773218	.0640628	-2.77	0.006	-.3028825	-.051761
age_years	.0272756	.0192767	1.41	0.157	-.010506	.0650573
HH_MEMBS	.0059466	.0425043	0.14	0.889	-.0773603	.0892535
_cons	-.6285927	.9795772	-0.64	0.521	-2.548529	1.291343

iii. Kernel matching

Logistic regression Number of obs = 557
LR chi2(10) = 202.92
Prob > chi2 = 0.0000
Log likelihood = -215.81216 Pseudo R2 = 0.3198

LN_APP	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
GRP	1.967401	.3632984	5.42	0.000	1.25535	2.679453
DIST_LNDR	-.0746152	.0222397	-3.36	0.001	-.1182043	-.0310261
EXP_TOM	.1530731	.0653625	2.34	0.019	.0249651	.2811812
educ_years	.1597055	.0450976	3.54	0.000	.0713158	.2480952
TOM_LAND	1.16628	.1739749	6.70	0.000	.825295	1.507264
Gender	-.613822	.2911048	-2.11	0.035	-1.184377	-.0432671
Maritstats	.1058612	.1457428	0.73	0.468	-.1797895	.3915119
EXTNSN	.3113923	.3265818	0.95	0.340	-.3286962	.9514808
L_ANN_INC	-.3261297	.1133278	-2.88	0.004	-.5482481	-.1040113
age_years	.0513303	.0325786	1.58	0.115	-.0125226	.1151832
_cons	-.877131	1.728973	-0.51	0.612	-4.265856	2.511594

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
net_income	Unmatched	6530063.57	2912534.18	3617529.39	476921.924	7.59
	ATT	6530063.57	2616214.58	3913848.98	986882.908	3.97

iii. Kernel matching

Logistic regression

Number of obs = 143

LR chi2(10) = 21.95

Prob > chi2 = 0.0154

Pseudo R2 = 0.1112

Log likelihood = -87.723645

credit_formal	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
GRP	.9003895	.4613635	1.95	0.051	-.0038663	1.804645
DIST_LNDR	.1929862	.067765	2.85	0.004	.0601692	.3258032
EXP_TOM	.2438009	.0811412	3.00	0.003	.0847671	.4028347
educ_years	-.0815194	.0661929	-1.23	0.218	-.2112552	.0482163
TOM_LAND	-.0213597	.2052839	-0.10	0.917	-.4237087	.3809893
Gender	.3577444	.4484958	0.80	0.425	-.5212913	1.23678
Maritstats	.1248791	.2170071	0.58	0.565	-.3004471	.5502052
EXTNSN	.1282528	.4801402	0.27	0.789	-.8128047	1.06931
L_ANN_INC	-.2136855	.1938808	-1.10	0.270	-.5936849	.1663139
age_years	-.1165178	.0604859	-1.93	0.054	-.2350679	.0020324
_cons	4.63342	3.039036	1.52	0.127	-1.32298	10.58982

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
net_income	Unmatched	5215945.45	7656450.52	-2440505.06	1347328.44	-1.81
	ATT	5184720.63	6808959.26	-1624238.62	1078702.44	-1.51

Appendix 4: Paper publication

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Determinants of Access to Credit among Youth Tomato Farmers in Mvomero District, Tanzania

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Abstract

Access to agricultural credit remains a key constraint to youth participation in high-value crop production in Tanzania. In rural areas, formal financial services are often limited, and youth face unique challenges including lack of collateral, minimal financial history, and limited knowledge of formal financial lending requirements. This study analyzes the determinants of access to agricultural credit among youth tomato farmers in Mvomero District, Tanzania. Data were collected from a cross-sectional sample of 562 youth aged 18 to 35 years using a structured questionnaire. A binary logistic regression model was applied to estimate the effects of socio-economic, institutional, and farm-level variables on credit access. The results show that level of education, farming experience, farm size, group membership, and proximity to lending institutions significantly and positively influenced access to credit. In contrast, longer distance to credit institutions and higher annual income were associated with reduced likelihood of borrowing. Gender also emerged as a significant factor, with female youth farmers more likely to access informal credit, possibly due to their stronger participation in organized social groups. These findings suggest that both structural barriers and social capital influence financial inclusion among youth in agriculture. The study recommends policies that support group-based lending models, enhanced financial literacy, and promotion of mobile banking solutions to expand credit access. Strengthening institutional support for youth in agribusiness can contribute to improved productivity, income, and long-term sector engagement.

Keywords: agribusiness, youth, credit, tomato, income, binary logit, Tanzania

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