

BINDURA UNIVERSITY OF SCIENCE EDUCATION



**FACULTY OF SCIENCE & ENGINEERING
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**The Impact of Mechanization in Smallholder Irrigation schemes: A Case
Study of the More Food for Africa Programme in Mashonaland East
Zimbabwe**

DECLARATION

I, Hassan L Plate, B192079B, I declare that, with the exception of what is noted in the acknowledgement and references, all of the research and work for this study was done by me. According to my knowledge NO other university has received this project, in whole or in parts.

Student's Signature: 

Date: _27_/_06_/20__

Academic Supervisor's Name: _____ **Signature:** _____

Date: ___/___/20__

Project Coordinator's Name: _____ **Signature:** _____

Date: ___/___/20__

ABSTRACT

This thesis investigates the impact of mechanization on smallholder farmers participating in the More Food programme, a government initiative aimed at improving agricultural productivity in rural areas. The study assesses the effects of mechanization on crops yields, crop quality, farming efficiency, machinery ownership and management and livelihoods of smallholder farmers in the programme. Data was collected through surveys, interviews, field observations in Marondera District Mashonaland East where the programme was implemented. The results show that mechanization increased crop yields, crop quality and farming efficiency leading to improved livelihoods and food security among smallholders. However, the study reviews challenges such as poor management of machinery and implements, poor repair and repair and maintenance strategies, high maintenance cost, limited access to spare parts and inadequate training which hinder the adoption and effective use of mechanized technologies. The study recommends strategies to address these challenges and improve the sustainability of mechanization initiatives among smallholder farmers. The findings contribute in impacting the benefits of mechanization and the development of effective agricultural policies and programmes that promote sustainable agricultural development and food security.

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TABLE OF CONTENTS

Contents	
CHAPTER 1	8
INTRODUCTION.....	8
1.2 PROBLEM STATEMENT	9
1.3.0 OBJECTIVES	10
1.3.1 Overall Objective	10
1.3.2 Specific Objectives	10
1.4 Research Questions.....	10
1.5 JUSTIFICATION	10
1.6 PROJECT AIM.....	11
1.7 SCOPE AND LIMITATION OF STUDY	11
CHAPTER 2	12
2.1 LITERATURE REVIEW	12
2.2 Theoretical Framework.....	12
2.3 Mechanization	13
2.4 Mechanization in Africa	13
2.5 Mechanization in Zimbabwe	14
2.6 Impacts of Mechanization	14
CHAPTER 3	15
METHODOLOGY.....	15
3.1 Introduction.....	15
3.2 Research Design	15
3.2.1 Research Approaches	15
3.3 Research Population	16
3.4 Sampling Technique	17
3.5 Data Collection	17

3.6 Data Analysis.....	17
3.7 Data Presentation.....	17
3.8 Ethical Consideration	18
3.8.1 Anonymity	18
3.8.2 Confidentiality.....	18
3.8.3 Informed consent	18
3.8.4 Participation	18
3.9 Validity and Reliability	18
CHAPTER 4	19
RESULTS	19
CHAPTER 5	23
5.1 Discussion of Results	23
CHAPTER 6	25
6.1 Conclusion	25
6.2 Recommendations.....	25
REFERENCES.....	26
Stakeholder Survey Questionnaire.....	27

LIST OF TABLES

Figure 1 shows histogram for ages of farmers	19
Figure 2 shows the machinery and implements owned by participants.....	20
Figure 3 shows yield of wheat	21
Figure 4 shows yield of maize	21
Figure 5 shows net income per season	22

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Agriculture plays a crucial role in Zimbabwe in both rural and urban areas. Most people in rural areas are dependent on agriculture for a living and people in urban areas are adopting farming as a business for extra income. There are three farm power sources commonly used in Zimbabwe and these are human power, animal power and mechanized power. The majority of small-scale farmers are familiar with human and animal farm power and rely on them agricultural productivity and mechanized power is only common at commercial level.

Agricultural mechanization is the application of mechanical technology and increased power to agriculture, largely as a means to enhance the productivity human labor and often to achieve results well beyond human capacity (Agricultural Mechanization in Africa, 2008). Agricultural mechanization is an evolving revolution to small scale farmers in Zimbabwe that is, a known convenience but unexplored. The revolution is being fueled by the government, parastatals and private sectors to achieved a mechanized agricultural system without drudgery relegating the hand-hoe to the museum and replace it with tillers (Nkosazana, 2012).

An irrigation scheme refers to a planned and organized system for suppling water to agricultural land, gardens or landscapes. Operation in agricultural schemes need to be mechanized for maximum utilization of land. Irrigation schemes setups benefit in food security, economic growth and development of small-scale farmers. Therefore, if the schemes are mechanized, they can serve their purpose profoundly.

The More Food for Africa International programme was created after the meeting Brazil-Africa Talks on Food Security, Hunger Alleviation Rural Development which was held in May 2010 Brasilia. The main goal was to ensure food and nutritional security via access to technology and mechanization for family and smallholder farmers. The methodology of the More Food for Africa programme involved four but integrated approaches: international cooperation between

developing countries on public policy, on family farming and agrarian development; access for least developed countries and middle-income countries to technologies, machinery, equipment and agricultural implements; technical cooperation for food production resulting in more resilient and more productive family farming; and export of agricultural machinery, equipment and implements from the Brazilian plant and processing industry. A Memorandum of Understanding was signed between Brazil and Zimbabwe in 2011 under the More Food for Africa for Africa (Mukwereza, 2015). The More Food for Africa programme assets were received in 2015. The assets were distributed via the Department of Agricultural Engineering Mechanization and Soil Conservation Mashonaland in different provinces. The assets were distributed to smallholder irrigation schemes in different provinces. The initiation of the More Food for Africa programme led to the mechanization of the irrigation schemes. The More Food for Africa programme mechanized the irrigation schemes with tractors, planters, disc ploughs to mention a few. The program empowered smallholder schemes with the asset of mechanization. Mashonaland East is one of the Provinces in Zimbabwe that has many commissioned irrigation schemes and these irrigation schemes were mechanized by the More Food for Africa programme.

1.2 PROBLEM STATEMENT

The revolution of agricultural mechanization has made a global and visible impact on agriculture, human and economic development promoting food security and sustainable live hoods. Agricultural mechanization holds the solutions that are at hand in agricultural developing countries as it satisfies the needs for maximization, timeliness operations, product quality and many other concerns. However small scale agriculture has been regarded as a laborious activity which was mainly reserved for the elderly in rural areas due to the use of primitive technology such as hoes, axes, ox-drawn ploughs etc. Small holders has ignored the aspect of mechanization yet wanting to achieve maximum levels of production and optimum yields but has experienced drawbacks such as drudgery, not meeting farming dates and a lot more other problems, hence from this background this study intends to assess the impacts of mechanization on small scale irrigation schemes.

1.3.0 OBJECTIVES

1.3.1 Overall Objective

To study the impact of mechanization in smallholder irrigation schemes facilitated by the More Food for Africa programme in Mashonaland East Province.

1.3.2 Specific Objectives

1. To assess the received machinery and implements by the irrigation schemes.
2. To assess the technical aspects of mechanization.
3. To assess the changes in the production and the socio-economic impacts of the mechanization program.

1.4 Research Questions

1. What implements and machinery does the irrigation scheme own?
2. What are the technical issues that were experienced by the irrigation scheme holders?
3. What are the socio-economic and production changes that were experienced by irrigation holders due to the mechanization programme?

1.5 JUSTIFICATION

The impacts of agricultural mechanization are nearly ignored and the potential that can arise from evaluations and assessments as people would only focus on wanting to have a maximum output out of the input in agriculture but not willing to accept the means to the destination. The researcher identified the ignored important aspect of agricultural mechanization in agriculture as the vital aspect for acquiring the desired results and achieving of goals and visions. The visions of sustainable agriculture, zero hunger and food security on sustainable development goals are directly affected by agricultural output which is tied to the efficiency of the methods of working hence focusing the spotlight on agricultural mechanization to expand, improve and bring efficiency and increase to agriculture. There rises the need to assess the impacts of agricultural mechanization over a period of time thus giving room for assessment, reviewing and evaluation of mechanization strategies

employed and formulating new ones for the mechanization of the nation. The study clearly displays the improvements and effectiveness of agricultural mechanization in agricultural operations. The study serves to impart the idea of mechanizing agriculture which is the destination to maximum production in agriculture.

1.6 PROJECT AIM

The findings of this project will not only add to the vast the knowledge about the impacts of agricultural mechanization in the development of agriculture, it importantly shows how mechanization has impacted the generality of farmers. The study is useful to bodies interested in agriculture and agricultural mechanization in monitoring and evaluating the effects of existing plans and policies and how it affects Zimbabwe and thereby making improvements and optimizations.

1.7 SCOPE AND LIMITATION OF STUDY

This study is primarily concerned with the impacts of agricultural mechanization in the development of agriculture in Mashonaland East.

This study is limited to Zimbabwe. The researcher encountered some constrains, which limited the scope of the study. These constrains include but are not limited to the following:

- a) **Time:** The time frame allocated to the study does not enhance wider coverage as the researcher had to combine other academic activities and examinations with the study.
- b) **Resources:** The researcher had limited resources access data and to access other places for more data collection.

CHAPTER 2

2.1 LITERATURE REVIEW

2.2 Theoretical Framework

Agricultural mechanization plays a pivotal in agricultural development by affecting the agricultural operations to yield a higher output, to reduce the cost and maximize the utilization of space and time and other vitalities. This is also in line with Mrema, Soni and Rolle (2014) who stipulated that the mechanization of the agricultural system is the primary element for increasing agricultural productivity, enhancing food security and sustainability of the entire agricultural system, especially in developing countries.

Smallholder agriculture plays an important role in the provision of better livelihood and food security in developing countries. This agrees with Adam and Hassan (2015) who argue that smallholder agriculture helps in sustaining livelihoods for farmers and communities through income generation and employment in South Africa. For decades smallholder farmers have been operating on human muscle, based on operations that depend on hoes and other hand tools and on animal power. Agricultural mechanization has been highlighted as an essential strategy and development goal for smallholder farmers in enhancing their productivity (Mottaleb, Krupnik and Erenstein, 2016). The use of agricultural mechanization is significant for smallholder farmers because it advances production efficiency, reassures large-scale production and increase in the farm quality produce. Ayandiji and Olofinsao (2015) contended that the use of agricultural mechanization by farmers has been realized as the spindle to agricultural rising in many parts of the world especially developing countries and it has contributed prominently to the amplified output of food crops and other agricultural products.

There are different mechanization strategies that can be employed depending on the population, demand and access of resources. Tractor and implement mechanization are an approach of mechanization to smallholder farmers that can boost their overall production. Such an approach also looks at population quantities per given area and the quantity of the assets to be allocated. Smallholder irrigation

scheme mechanization can be an effective strategy in mechanizing a population in a given area.

2.3 Mechanization

The word mechanization comes from the Greek word mekhanikos which means inventiveness or ingenious. Mechanization implies the introduction of machines into a process, activity or work. Mechanization dates back to centuries ago spanning in many countries, human muscle and animals were primary sources of power thus leading to the ingenious of certain individuals to invent working machines. The journey of mechanization is quite amusing as there were changes and developments of invents from time to time. The first invention to mechanize dates back to the BCs as mechanical machines like the shadoof were invented in the Mesopotamia Empire and Egypt to raise water for all purposes. Then steam powered machines were invented like savery pump and the first tractor. Then it went on to fuel power machines. All these developments were key to the rise in industrial revolution as manual labor was replaced with machines and economic developments of countries globally. Mechanization to this day is being implement at all levels from industrial, mining and agriculture.

2.4 Mechanization in Africa

Agricultural mechanization in Africa is steal on the verge of development. African countries are progressing in mechanization from home/ family to small scale mechanization. Mechanization has significantly enhanced farming operations from general operations to critical operations. There are four types of mechanical power used in Africa; tractors, motorized pumps, motorized harvesting and post-harvesting equipment and grain-milling equipment. On tractors we have both the 4-wheel tractors and the 2-wheel tractors and on the 4-wheel tractors we have both the 4-wheel drive and 2-wheel drive tractors. Not for long the 2-wheel tractors have been introduced to mechanize homes and smallholder farmers. The 2-wheel tractor has empowered Ethiopian smallholder farmers as there is potential increase in productivity and reduction in labor (CIMMYT, 2015). Mechanization of agricultural has proven to be solving agriculture related problems and brought positive contribution on economic development.

2.5 Mechanization in Zimbabwe

Mechanization in Zimbabwe is on the verge of development, improvement and acceptance as traditional forms of farm mechanization are still dominant in most parts of the country. Traditional mechanization methods such as using hoes to weed, using oxen as for draft and for transport with carts, ox-drawn moldboard ploughing, hand threshing, knapsack spraying and many other are still the most relied upon methods. This is in line with FAO and AUC 2018 that said more than 80% farmers are reliant on manual labor. The majority of smallholder farmers are using a combination of outdated mechanization methods and manual labor. Using manual labor constrains how much farm land households can cultivate and how much produce they can handle (Sims and Kienzle, 2016). The only way to improve and upgrade is via mechanization of all agricultural systems and it is the news bulleting in every pocket of the country. The government is one of the major drivers of agricultural mechanization stirred via the Department of Agricultural Mechanization and Soil Conservation under the Ministry of Lands, Agricultural, Fisheries, Water and Rural Development which is promoting agricultural mechanization also in union with AFC bank. Other private sectors like CYMMIT and companies like Prochoice are showcasing and doing exhibitions spreading the mindset and technology

2.6 Impacts of Mechanization

Agricultural mechanization relieves labor weight of the shoulders of farmers and reduces drudgery, timeliness loses and increases work efficiency. Agricultural mechanization saves time and operations are done at planned time. Agricultural mechanization is a pillar of food security in that it promotes high yields, longer yield storage life and long nutrition life thus promoting food security overtime. Agricultural mechanization promotes agricultural development and economic growth and improves the socio-economic status of farmers. Agricultural mechanization promotes diversity throughout farming season.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This topic serves the research design and methods to be used for data collection. Data

3.2 Research Design

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. (CR Kothari 2004). The research design is a conceptual structure within which research is conducted and it constitutes the blue print for the collection, measurement and analysis of data.

The research focuses on the impacts of mechanization in smallholder irrigation schemes facilitated by the More Food for Africa programme in Mashonaland East Province in Zimbabwe. The research is achieved by using case study research method. The case study method is a form of qualitative analysis where in careful and complete observation of a situation is done efforts are made to study each and every aspect of the concerning unit in minute details and then from case data generalizations and inferences are drawn.

3.2.1 Research Approaches

There are two basic approaches in research, quantitative and qualitative approach. The quantitative approach involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion (CR Kothari, 2004)

The qualitative approach in research is concerned with subjective assessment. Such an approach to research generates results either in non-quantitative form or in the form which are not subjected to rigorous quantitative analysis. The qualitative approach will be used in the research for gaining in-depth sights (CR Kothari, 2004).

3.3 Research Population

A research population is defined as the entire group of people or things that a researcher is interested in studying. (Creswell, 2012). The research population can then be used to determine a sample size. This study is focusing on smallholder irrigation schemes that were mechanized by the More Food for Africa programme and information will be collected from the irrigation schemes holders and from the Department of Agricultural Engineering, Mechanization and Soil Conservation. The table below shows selected irrigation schemes and selected population per scheme

Formula for determining sample size:

$$n = \frac{z^2 \cdot N \cdot \sigma_p^2}{(N - 1)e^2 + z^2 + \sigma_p^2}$$

N = size of population

n = size of sample

e = acceptable error

σ_p = standard deviation of population

z = standard variate at a given confidence level

Confidence interval for μ is given by:

$$\bar{X} \pm z \frac{\sigma_p}{\sqrt{n}} \times \sqrt{\frac{(N - n)}{(N - 1)}}$$

Table 1 list of Irrigation Schemes

Irrigation scheme	Total population	Sample population
Nyamakaira	14	5
Machiki	18	5
Madhibhura	16	5

3.4 Sampling Technique

Stratified sampling was adopted as it allows the researcher to ensure that the sample is representative of the population as a whole and is used in qualitative approach. The choice of Province for investigation was inspired by accessibility and exposure and also the choice of the irrigation schemes was assisted by the Department of Agricultural Engineering Mechanization and Soil Conservation Mashonaland East. Non-probability sampling was the basis of choice on the irrigation schemes.

3.5 Data Collection

In collecting data, structured questionnaires were used with closed-ended questions and fixed alternatives questions in which the response of the informants are limited to the stated alternatives and interviews are conducted in person.

3.6 Data Analysis

Content analysis will be used to analyze data and quantitative data will be in form of descriptive statistics, means, median, chi-square, correlations and comparative analysis.

3.7 Data Presentation

The collected data is analyzed using Excel and (the results will satisfy objective of

the research. The analyzed data will be presented using tables, pie charts and graphs.

3.8 Ethical Consideration

3.8.1 Anonymity

The identity of the participants will be anonymous.

3.8.2 Confidentiality

The researcher will not share any information about the participants with anyone outside the project.

3.8.3 Informed consent

The researcher makes sure that the participants are truly able to give informed consent and are not coerced into participating.

3.8.4 Participation

The researcher makes sure that the participants are fully informed.

3.9 Validity and Reliability

To ensure validity and reliability information provided will also be confirmed by the Department of Agricultural Engineering, Mechanization and Soil Conservation.

CHAPTER 4

RESULTS

Name of irrigation scheme	Location
Machiki Irrigation Scheme	Marondera District
Nyamakaira Irrigation Scheme	Marondera District
Madhibhura Irrigation Scheme	Marondera District

Table 2 shows names of irrigation schemes and their location

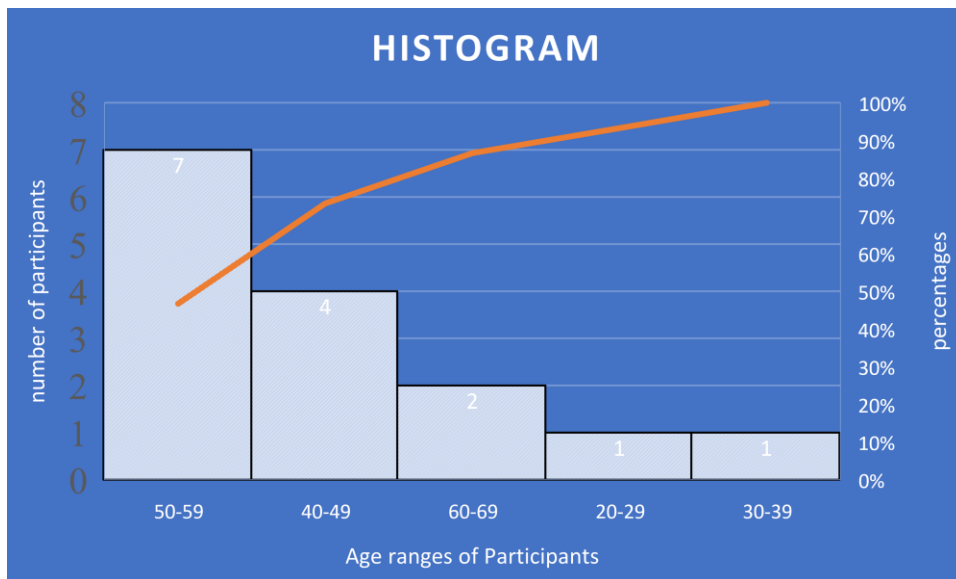


Figure 1 shows histogram for ages of farmers

Machinery and implements	Nyamakaira Irrigation Scheme	Machiki Irrigation Scheme	Madhibhura Irrigation Scheme
Tractors	Not Functional	Functional	
Disc plough	Not Functional	Functional	
Disc harrow	Not Functional	Functional	
Planter	Functional	Functional	
Spreader		Functional	
Boomspray		Functional	
Sheller			

Table 3 shows machinery owned in the irrigation schemes

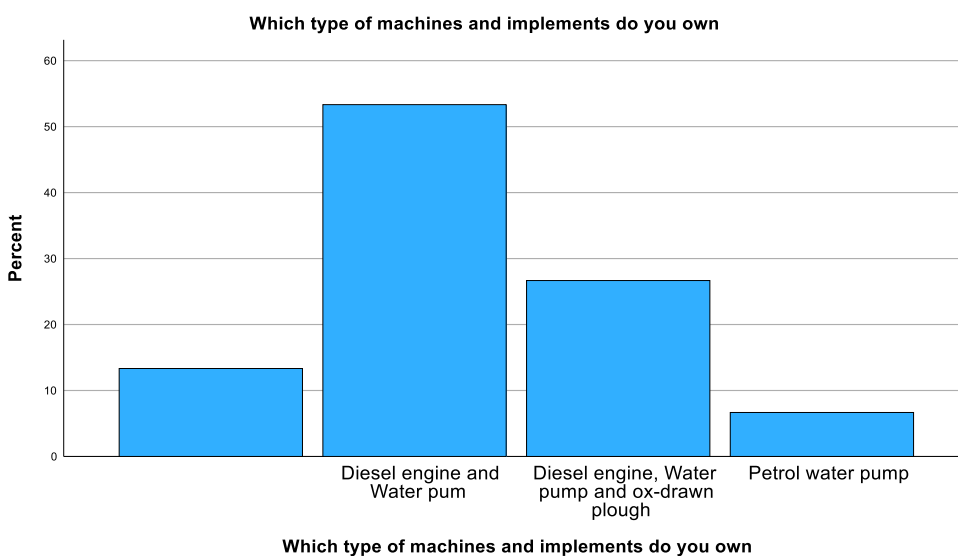


Figure 2 shows the machinery and implements owned by participants

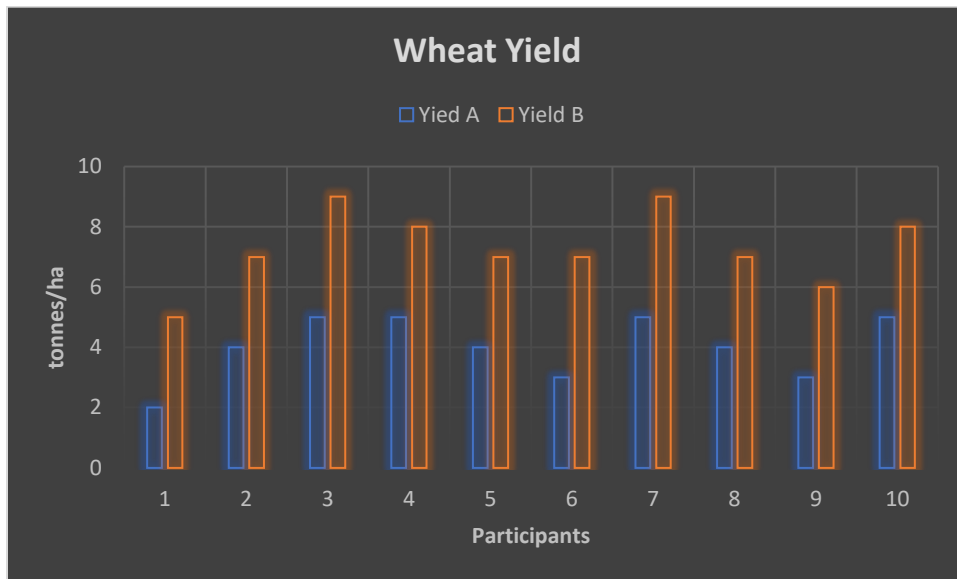


Figure 3 shows yield of wheat

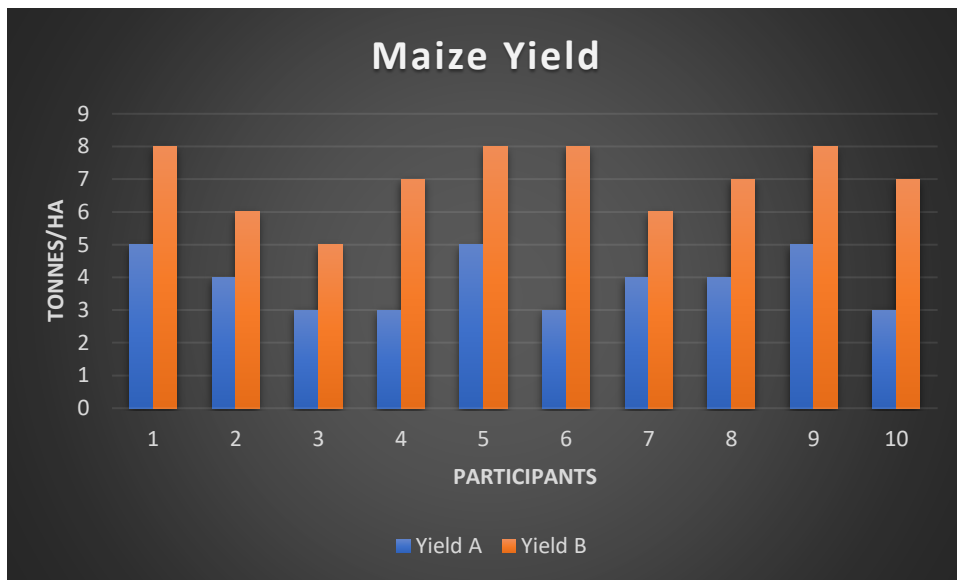


Figure 4 shows yield of maize

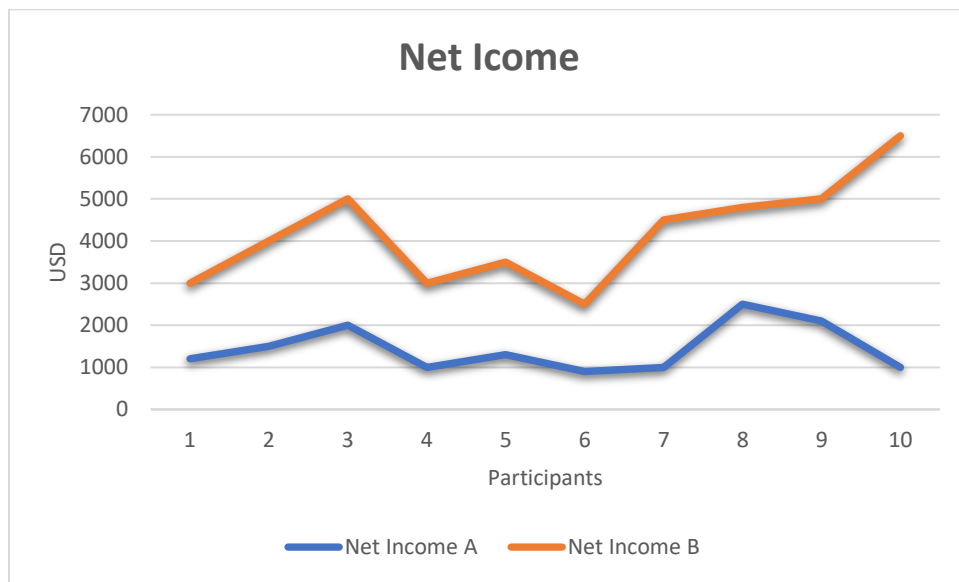


Figure 5 shows net income per season

CHAPTER 5

5.1 Discussion of Results

The three irrigation schemes as presented on the bar charts had individuals of the same occupations with different ages showing that youth are less participative in the agricultural and adults only are the most participative and active in the agricultural sector. This is supported by Chipfupa, U, Wale and E (2021) who said that youth are less participative in agriculture because of the perception that it is a poor man's occupation characterized with laborious activities and low economic return and social status. This information was gathered from the same district thus Marondera District. The ratio of women to men who are participative in agriculture was below average as well. The participation is also affected by the level of mechanization, this agrees with SAMS (2017) as it states that sustainable mechanization encourages people to participate in farming by reducing labor, increasing productivity and market access.

Basing on the analyzed data of three different irrigation schemes and five individuals per irrigation scheme being the sample population, the first irrigation scheme (Machiki) had all its tractors and implements working, the other the tractors and implements were down (Nyamakaira) and lastly the last one was not mechanized (Madhibhura). Ownership of tractors, implements and machinery depended on the donated tractors and implements offered to the scheme and ownership by buying. The mechanized schemes were in joint ownership whilst also other individuals owned similar assets. The results also show on frequency tables that mechanized schemes had tractors and implements and would differ according to schemes. The access to machines and implements was dependent on membership to the irrigation scheme and individual ownership, thus scheme owned machinery and implements were easily accessible to scheme members and individually owned to the individuals and the rest had to book for access to machinery and implements services. This is in line with a study conducted in Ethiopia that showed that farm machinery is related to access to machinery services in agriculture (Agricultural Machinery, 2023). In comparison of the three irrigation schemes farmers at Machiki irrigation scheme had easy access while

both the farmers of the remaining had to book in order to access machinery and implement services and Ahmed and Miller (2023) also agreed that access is dependent on ownership thus ownership has the convenience of easy access. In terms of machinery and implement management, Machiki irrigation scheme possessed great management skills compared to Nyamakaira irrigation scheme neglecting Madhibhura irrigation scheme in terms of machinery management as it was not yet mechanized, the machinery and implements were working well and up to date on service record while at Nyamakaira the machinery were down due service issues and other underlying factors such as conflicts between scheme members. This is based on the results as its clear on functioning and non-functioning equipment of the irrigation schemes. Agricultural Machinery Management (2021) agrees to it and states that the management of agricultural machinery is a crucial component of any mechanization program. Some of the irrigation scheme members had access to use of machinery and implements in various ways and due to that, the service prices would vary due to location and ownership and the cost was dependent on the job to be done. The data shows different prices as some of the factors were determined by ownership and hiring thus members of the irrigation scheme incurred less in machinery and implement services compared to others who hired. Based on the results the mechanized irrigation schemes would only employ repair and maintenance when it was needed. Machiki irrigation scheme had better consistent in the repair and maintenance of machinery and implements since all assets were functioning compared to Nyamakaira irrigation scheme were none of the machinery and implements were functioning. Supported by (<https://www.lumin.ai/blog/what-are-maintenance-cost/>) that states consistency in repair and maintenance is crucial to extend the lifespan of a machine and prevent unexpected failures. The data also shows that hectares increased due to use and access to equipment and machines and crop quality, diversity and yield greatly increased thus a positive effect on production due to positive outcomes. As farmers are dependent on their produce for income, due to the increase in production level it also resulted in increased income hence a change in their socio-economic status. Mdoda and Gidi 2022 supports that agricultural productivity is related to mechanization as the study was conducted on smallholder farmers and it was proved that agricultural mechanization leads to increased productivity, farm returns and crop intensity.

CHAPTER 6

6.1 Conclusion

Based on the evident findings, agricultural mechanization has a positive impact on the agricultural activities carried out by farmers. Agricultural mechanization is the sole savior of the lagging development and improvements in agriculture and its application answer to the need to be productive, to need to make more money and to own and manage assets. The promotion of mechanization in agriculture enables and empowers farmers to excel in all aspects of practice. Agricultural mechanization as a whole promises a future with food security, economic sufficiency, trade and a lot more positive ever imagined conveniences.

In a nutshell machinery has to be effective in order for the machinery to be in good condition and it is closely related to technical aspects such as repair and maintenance as both work hand in hand in that were there is good repair and maintenance being employed there is good management and good management promotes a longer lifespan for the machinery and equipment. All of it effectively employed increases farm productivity as the work will be mechanized and high productivity results in high output which in turn has high returns hence increasing income and changing the socio-economic status of the farmers

6.2 Recommendations

I recommend every farmer to leave the ancient ways of farming and adopt to the innovativeness of engineering in mechanizing agriculture as this the way to machinery and implement ownership, management, productivity, personal wealth and food and health security. Agricultural mechanization in all agricultural practices is the way to go since every agricultural practice can be mechanized to perfect the job and obtain greater results. Agricultural mechanization also needs to be managed for a long life of convenience in working and adoption to innovative changes is always necessary.

REFERENCES

Anon., 2017. Sustainable Agriculture Mechanization for Smallholders: What Is It and How Can We Implement It?. *Agriculture*, Issue 6, p. 50.

Anon., 2021. The Role and Impact of Agricultural Machinery Service.

Anon., 2023. *Quantifying the Economic Impact on Farmers from Agricultural Machinery*. [Online]

Available at: <https://doi.org/10.3390/world4020022>

Anon., 2024. [Online]

Available at: <https://www.lumin.ai/blog/what-are-maintenance-cost/>
[Accessed 6 June 2024].

AYANDIJI, A. & O. O. T., 2015. *Socio-Economic factors affecting Adoption of Farm Mechanization by Cassava Farmers in Ondo State, Nigeria, Nigeria*:

AYANDIJI, A. & OLOFINSAO, O. T.

Chipfupa, U. W. E., 2021. Youth Participation in Agriculture. *Local Development & Society*, pp. 1-8.

Creswell, J. W., 2012. *Educational Research; planning, conducting and evaluating quantitative and qualitative research*. fourth ed. Boston, USA: Library of Congress.

KOTHARI, C., 2004. *Research Methods*. SECOND REVISED EDITION ed. Jaipur, India: New Age International (P) Ltd.

Mdoda, L. I. M. S. T. C. D. M. C. & G. L., 2022. The impact of agricultural mechanization on smallholder agricultural productivity. *African Journal of Agricultural Extension*, pp. 1-18.

MOTTALEB, K. A. K. T. J. & E. O., 2016. *Factors associated with small-scale agricultural machinery in Bangladesh*, Bangladesh: MOTTALEB, K. A, KRUPNIK, T. J & ERRENSTEIN, O.,.

UNIDO, F. a., 2008. *Agricultural Mechanization in Africa*, Vienna: FAO.

Stakeholder Survey Questionnaire

My name is Hassan Plate, I am a student at Bindura University of Science Education studying for a BSc honors degree in Agricultural Engineering. I am carrying out a study entitled The Impacts of Mechanization on Smallholder Irrigation Schemes; can you kindly take your time to respond to the questions below.

Name of Irrigation Scheme:

Location:

Name of participant:

Gender:

Age:

Occupation:

Which type of implement/equipment do you use owned at your irrigation scheme

Machinery	
Tractor	
Planter	
Disc plough	
Rom	
Ripper	
Sheller	
Vicon	
Boom spray	
Other	

Ownership status

Which type of machines do you own, owned by the scheme or hire from outside

	Self-owned	Scheme owned	Hire from outside
Tractor			
Planter			
Disc plough			
Rom			
Ripper			

Sheller			
Vicon			
Boom spray			

Machinery management

State the size of your land holding in the scheme

0-1ha	1-2ha	2-3ha

State the frequency of the use of the equipment

	Daily	Weekly	Monthly	Seasonally
Tractor				
Planter				
Disc plough				
Roam				
Ripper				
Sheller				
Vicon				
Boom spray				

How easy or difficult is it to access machinery at your scheme?

	Easily available	Have to book and wait	Very difficult	Not sure
Tractor				
Planter				
Disc plough				
Roam				
Ripper				
Sheller				

Vicon				
Boom spray				

How much do you spend on machinery on the following operations per hectare?

Ploughing	
Ripping	
Discing	
Planting	
Spraying	
Weed control	
Harvesting	
Threshing	
Transport	

How do you access repair and maintenance services for your machines tick below?

We have our technician	We take them to a local dealer	The Department of Agricultural Engineering Mechanization and Soil Conservation does the repair	Others

How often do you carryout repair and maintenance operations?

	Daily	Weekly	Monthly	When there is need
Tractor				
Planter				

Disc plough				
Roam				
Ripper				
Sheller				
Vicon				
Boom spray				

How old are the machinery?

	Age
Tractor	
Planter	
Disc plough	
Roam	
Ripper	
Sheller	
Vicon	
Boom spray	

Technical Aspects

To what extent has the mechanization program improved the following aspects

	None	To some extent	To a significant extent
--	-------------	-----------------------	--------------------------------

Improved timeliness of operation			
Reduced drudgery			
Improved quality of operations			
Increased yields			
Increased production area			

Changes in production

How has the use of machinery affected your crop yield per season?

Previous yields (t/ha)	Current yields (t/ha)

How has the use of machinery affected your crop quality per season?

Previous quality			Current quality		
Low	Medium	High	Low	Medium	High

How has the use of machinery affected your crop diversity per season?

Previously		Currently	
Decreased	Increased	Decreased	Increased

Socio-economic Impacts

What is your net income from farming?

Previous	Current

From the proceeds of mechanization can you say you have managed to acquire the following assets/achievements?

	Tick
Managed to build a house	
Can afford three meals/healthy food	
Can easily pay school fees	
Have access to electricity from the grid or solar	
Bought livestock	
Managed to drill a borehole at home	
Bought a car	
Employ party time or permanent labor	
Any accidents of malnutrition	