ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIE

CHALLENGES AND OPPORTUNITIES OF IRRIGATED WHEAT PRODUCTION PROJECT ON SMALL HOLDER FARMERS; THE CASE OF GELAN GUDA SUB CITY

BY

DIGAFE MEKONNEN

MAY, 2024

ADDIS ABABA. ETHIOPIA

CHALLENGES AND OPPORTUNITES OF IRRIGATED WHEAT PRODUCTION PROJECT ON SMALL HOLDER FARMERS; THE CASE OF GELAN GUDA SUB CITY

BY

DIGAFE MEKONNEN

A THESIS SUBMITED TO ST.MARY'S UNIVERSITY, SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF PROJECT MANAGEMENT

MAY, 2024

ADDIS ABABA, ETHIOPIA

ST.MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

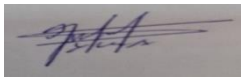
FACULTY OF BUSINESS

CHALLENGES AND OPPORTUNITES OF IRRIGATED WHEAT PRODUCTION PROJECT ON SMALL HOLDER FARMERS; THE CASE OF GELAN GUDA SUB CITY

BY

DIGAFE MEKONNEN

APPROVED BY BOARD OF EXAMINERS

----------	----------	----------
Dean, Graduate Studies	Signature	Date
Muluadam Alemu (PHD)	------  ----------	-02/07/24-------
---------		
Advisor	Signature	Date
Yilkal Wassie (Asst.prof)		02/07/24
External Examiner	Signature	Date
----------	----------	----------
Internal Examiner	Signature	Date

DECLARATION

I, the undersigned, declare that this thesis is my original work; prepared under the guidance of Dr.Muluadam Alemu. All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

Name Signature

St. Mary's University College, Addis Ababa May, 2024

ENDORSEMENT

This thesis has been submitted to St. Mary's University, School of Graduate Studies for examination with my approval as university advisor.

Muluadam Alemu (Ph.D) 

Advisor Signature

St. Mary's University, Addis Ababa JULY, 2024

ACKNOWLEDGEMENT

First of all l want to thank the Almighty God for his limitless blessing in my life and bringing me to this end through many ups and down. Then I would like to express my sincere appreciation and gratitude to my advisor, Dr. Muluadam Alemu for his deep, valuable guidance and counsel throughout the whole process of the study.

I would also like to thank staff of Gelan Guda sub city agricultural office, Gelan Guda district office and community of Meteli, Buludo and Akindo I didn‘t forget your rationality. Last but not least, I would like to extend my deepest love, respect and appreciation to my families and all my friends for their support, understanding and encouragement.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

GDP	Gross Domestic Product
AfDB	African Development Bank
CSA	Central Statistics Agencies
FAO	Food and Agricultural Organizations
ICARDA	International Agricultural Research in the Dry Areas
TAAT	Technologies for African Agricultural Transformation
FGD	Focus group discussion
SMF	Small holder farmers

ABSTRACT

The Ethiopian economy is based on agricultural activity, which is mainly subsistent and encountered different socio-economic challenges. Stemming from this logical ground, *This study aimed to identify the challenges and opportunities of an irrigated wheat production project in Gelan Guda sub city in gelan guda district in three geres (meteli, buludo and akindo), Oromo regional state of Ethiopia. Cross-sectional data was gathered from 109 randomly selected irrigated wheat producers in the district. The collected data was analyzed using Microsoft Excel and Stata software. Descriptive statistics such as frequency, percent, and mean were used to explain the data. The result of this study surprisingly, the respondents' entire livelihood was dependent on crop, vegetable, and livestock production. The result of this study confirms that flood, wheat disease and pest problems, and input supply challenges such as limited access to quality seeds, fertilizers, and agrochemicals, low productivity, and wheat attacking birds are the top five challenges of irrigated wheat production. On the other hand, the study identifies several opportunities that can bolster irrigated wheat production in the district. Accordingly, the presence of irrigable land , high commitment from the government, and robust demand for wheat are the top three opportunities for irrigated wheat production. Based on the results, this study concludes that the existence of irrigated wheat production is hindering challenges and opportunities in the district. Therefore, the government and non-government organizations should give special attention to identified challenges and use existing opportunities to enhance wheat production using irrigation projects.*

Key words: Irrigated wheat production, Challenges, productivity, Opportunities, gelan guda

CHAPTER ONE

INTRODUCTION

This chapter is introductory part of the entire study. It provides some insights about the ground and assumptions where the study is conducted. It states background, statement of the problem, objectives, significance, scope, limitation and organization of the study. Accordingly, it begins with background of the study.

1.1 Background of the Study

The Ethiopian economy as a whole is highly correlated to the agricultural sector which contributes 34.1% to the Gross Domestic Product (GDP), 79% of export earnings, 79% workforce for the population and 70% of raw materials for industry (Zegeye, *et al*., 2022).

The agricultural sector of the country relies predominantly on rainfall, with small-scale farming. This reliance on natural precipitation coupled with limited access to crucial resources such as technology, extension services, market insights, and credit facilities has significantly hampered agricultural productivity across the country (Kifle, 2022).

Over the span of the last four decades, it's evident that agricultural production growth in the country has failed to keep pace with the burgeoning rate of population growth. This concerning trend underscores a persistent imbalance between food supply and population needs, posing significant challenges to food security and socioeconomic development. Despite various efforts to boost agricultural productivity, the rate of expansion in output has consistently trailed behind the rapid increase in population figures (Regasa *et al*, 2021).

As the population continues to expand at a higher rate, projections indicate a corresponding surge in food requirements over the coming years. Meeting these escalating demands necessitates a substantial increase in stable crop production, with estimates suggesting that the current output levels must double to sustainably support the growing population (Noort *et al*, 2022).

Prioritizing irrigation-based agricultural expansion, particularly for major staple crops, represents a proactive and pragmatic approach to addressing the looming food security challenges in the

face of population growth. By leveraging irrigation to maximize crop yields, optimize resource use, and build resilience against climate shocks, nations can pave the way for a future where food scarcity is a relic of the past, and every individual has access to nutritious and affordable food (Ozkan *et al.*, 2022).

Ethiopia's remarkable position as the second-largest wheat-producing country in Africa, trailing only behind Egypt, underscores its significant contribution to regional food security and agricultural development. This achievement is a testament to the country's rich agricultural heritage, diverse agro ecological zones, and the resilience of its farming communities. The cultivation of wheat in Ethiopia is deeply ingrained in the cultural and economic fabric of the nation, dating back centuries to ancient civilizations. Today, wheat production spans the length and breadth of the country, encompassing diverse landscapes ranging from the highlands of the Ethiopian Plateau to the lowlands of the Rift Valley (Tadesse *et al*., 2019).

Wheat stands as a cornerstone among Ethiopia's strategic crops, pivotal for ensuring food security, facilitating import substitution aiming to reduce reliance on foreign wheat imports, and serving as a crucial raw material for the burgeoning agro-processing industry to produce diverse array of processed food products such as flour milling, pasta, snacks, and confectioneries (Endalew *et al*., 2020).

Ethiopia ranks as the second-largest wheat producer in Africa, trailing only behind Egypt. With an annual production of 5.5 million metric tons, Ethiopia contributes significantly to the continent's wheat output, accounting for 21.7% of total production and 18.3% of the wheat area harvested (FAO, 2020).

According to data from the Ethiopian Statistics Services CSA, 2020, wheat cultivation covers approximately 12.2% of the harvested area, spanning 1.9 million hectares. This sector employs around 20.2% of the total agricultural workforce, supporting 4.9 million subsistence smallholder farmers across the country. Regionally, the majority of wheat production originates from key regions such as Oromia, which contributes around 53% of the wheat area and 57-58% of the national production. Additionally, Amhara accounts for 34% of the wheat area and 28-32% of the production, while SNNP (Southern Nations, Nationalities, and Peoples) region covers 8% of

the wheat area and production, and Tigray contributes 5% of the wheat area and 3-6% of the production.

The demand for wheat in the country is experiencing an unprecedented surge, outpacing the growth rates of virtually every other food crop. Wheat's versatility and convenience make it a preferred choice for consumers seeking quick and easy meal options. Its adaptability to various culinary traditions and preferences, coupled with its long shelf life and ease of storage, has cemented wheat's position as a dietary staple. This escalating demand can be attributed to a myriad of factors, including population growth, urbanization, changing dietary preferences, and economic development (Noort, 2022).

Transforming wheat production and enhancing productivity have become top national priorities in Ethiopia. Efforts are underway to rapidly increase self-sufficiency through the expansion of cultivation areas, particularly in lowland and midland regions capable of supporting double cropping; leveraging available water sources (Bentley *et al*., 2022).

Recently, the Government of Ethiopia has embarked on a strategic initiative to bolster wheat production through the implementation of a wheat irrigation policy. This policy represents a concerted effort to revolutionize wheat cultivation by harnessing the potential of irrigated agriculture and deploying cutting-edge technologies tailored to the unique agro ecological conditions of major wheat-growing regions (Shikur, 2020).

Irrigation stands as the cornerstone of efforts to ensure food security, alleviate poverty, and catalyze economic growth in the country, particularly through the augmentation of wheat yields. Using irrigation technologies not only mitigates the risks associated with erratic rainfall patterns but also empowers farmers to sustainably enhance agricultural productivity and livelihoods (Gurmu *et al*., 2019). It serves as lifeline for agricultural communities, providing a reliable and consistent supply of water to nourish crops, particularly high-value staples like wheat.

Small-scale irrigation schemes play a pivotal role in driving the national economy, contributing significantly to agricultural productivity and rural livelihoods. Accounting for approximately 80% of the total irrigated land in the country, these grassroots initiatives represent a bedrock of resilience and sustainability within the agricultural sector (Asrat *et al*., 2022).

Despite their relatively modest size, small-scale irrigation schemes have a profound impact on food production, income generation, and poverty alleviation. Spanning areas of less than 200 hectares, these schemes empower local communities to harness water resources effectively, enabling year-round cultivation and diversification of crops (Alemu and Tolosa, 2022; and Muluneh, 2022).

Oromia stands out as a prominent regional state, boasting vast expanses of fertile land, particularly renowned for its arable potential. Among its agricultural pursuits, irrigated wheat production emerges as a flagship endeavor, showcasing the region's commitment to harnessing its land and water resources for sustainable farming practices. With an eye on maximizing agricultural output, the government has accorded significant importance to the cultivation of wheat in both lowland and midland areas within Oromia. This strategic focus underscores a concerted effort to leverage the region's inherent advantages and foster a thriving agricultural sector that not only meets local needs but also contributes to broader economic growth and food security initiatives (Abera *et al*., 2022).

Nestled within Ethiopia's verdant landscapes, Oromia stands as a beacon of agricultural abundance, boasting sprawling expanses of fertile land ripe with potential. Renowned for its arable richness, this regional state epitomizes the agricultural heartland of the nation. Amidst this fertile tapestry, irrigated wheat production emerges as a flagship endeavor, emblematic of regions steadfast commitment to harnessing its natural resources for sustainable farming practices. Under the stewardship of the government, wheat cultivation receives the utmost priority, with strategic investments and policy support aimed at maximizing yields and ensuring food security for all (Abera *et al*., 2022).

This study was delved into the identification and analysis of challenges and opportunities of irrigated wheat production for the success of irrigated wheat production in the region. Moreover, the study sought to identify opportunities that could be leveraged to enhance the productivity and sustainability of irrigated wheat production in the Oromia region, with a specific focus on the Gelan Guda sub-city.

1.2 Statement of the problem

Ethiopia, one of the largest wheat-producing nations in sub-Saharan Africa, faces substantial challenges in meeting the demand for this staple crop. Despite cultivating wheat across 1.7 million hectares annually, with a production estimated between 5 and 6 million tons, the country struggles to bridge the gap between demand and supply. Factors such as rapid population growth, evolving food preferences favoring value-added products, demographic shifts from rural to urban areas, the impacts of climate change, and both national and global conflicts contribute to this disparity (FAO, 2020).

To compensate for the shortfall, Ethiopia annually spends over USD 700 million on wheat imports. In response, the government initiated irrigated wheat production as a strategic move towards self-sufficiency and even exportation (IFPRI, 2019).

Gelan Guda sub-city holds significant promise for wheat production, particularly following the government's push to increase domestic wheat production and reduce reliance on imports. This has led to a surge in cluster irrigated wheat farming in the region. While smallholder farmers have begun cultivating wheat in response to government initiatives, they face numerous challenges in the production process. For example, flooding deter them from cultivating wheat in areas near rivers, the small holder farmers are not interested for wheat as compared to vegetables making it less appealing for farmers. Moreover, the extended harvesting time for wheat, spanning four months, contrasts sharply with the shorter harvest periods of one to three months for vegetables, and shortages of inputs further compound the difficulties faced by farmers in this endeavor.

These challenges have detrimental effects on farmers' incomes, drive up the costs of vegetables, and jeopardize the government's wheat production objectives. Addressing these issues is crucial for achieving sustainable wheat production and enhancing food security in Ethiopia. On the other hand, there are many opportunities of irrigated wheat productions such as existence of irrigable land, demand of wheat compared to other staple crops, and government attentions. Theses study was conducted to identify major challenges and opportunities of irrigated wheat production project in Gelan Guda sub city.

1.3 Research Question

- What are the characteristics of irrigated wheat producers in study area?
- What are the major challenges of irrigated wheat production in the study area?
- What are the opportunities of irrigated wheat production in the study area?

1.4 Objective of the study

1.4.1 General objective

The general objective of this study was examining the challenges and opportunities of irrigated wheat production project in Gelan Guda sub city, Sheger city administration.

1.4.2 Specific objective

- To assess the characteristics of irrigated wheat producers in study area.
- To identify the major challenges of irrigated wheat production in the study area.
- To assess the opportunities of irrigated wheat production in the study area.

1.5 Significance of the Study

Ethiopia is agriculture base country, over 80 percent of Ethiopian population lives in rural area are heavily dependent on rain-fed agriculture; and extremely vulnerable to changes in weather conditions in terms of productivity and income they earn per year (Abduselam, 2017). This study needed to examine the main challenges and opportunities of irrigated wheat production of small holder farmers. The problem of low wheat production was happening per year and makes livelihood of farmers stagnant. Because of the small holder farmers in the rural area, use limited opportunities and challenge face mechanism or not at all the decisive factors of wheat production. Therefore, this study is important to forward relevant responding mechanisms and the possible remedies, to minimize the challenges and increase opportunities on irrigated wheat production. It has multiple importance;

- ✓ It is important for agricultural office in the government bodies and the non-governmental organizations would utilize the recommended propounds to solve the small holder farmers irrigated wheat production failure problems.

- ✓ In addition, this study would benefit the academicians as base for further investigation in related socio-economic problems of the rural society.
- ✓ Furthermore, it is very important for the small holder farmers, that they would think back about themselves and take care for their livelihood, i.e. it makes awareness among the victims of the low wheat problem.

1.6 Limitation of the study

This research problem is longstanding and covers large area, so the researcher tried to make it manageable to conduct in the specific period and as possible, as utilize the relevant data in the study area. However, to some extent, the lack of full access to the recorded data was happened, and the small holder farmers hadn't not record the exact production amount, irrigated land, challenge faced and expenditure data, there would be sampling restrictions and lack of practical witness in the methodologies applied in the analysis, also there is lack of up to date literature in the study area happened. Therefore, some of these restrictions had been out of the researcher control and to some extent might hinder the attainment of intended objectives.

1.7 Scope of the study

This study geographically confined to conveniently selected study zone and purposively selected Gere then the locality of three sub-gere namely Meteli,Buludo and Akindoo .

Hence, the scope of the study will limited and only confined to the challenges and opportunities of irrigated wheat production project on small holder farmers in the case of gelan guda sub city in Oromia region.in this study the researcher only will tries to examine challenges (problems) and opportunities on small holder farmers and will give directions to increase productivity.

This study was utilized a cross-sectional survey data from sample respondents selected through systematic random sampling technique. The mixed type characterized, quantitative and qualitative methods of data. Because, the researcher needed to draw conclusions, which are valid for the whole population in the study area, so derived a sample in such a way that it was representative of that population. In addition, the qualitative data such as demographic and socio-economic data also collected by semi-adjusted questioners. Among the sample size, the sample of study selected from 150 households, according to Yamane sample calculation formula about

e=5%, which is needed because of the population of the study area is moderately large. Accordingly, any of the analysis of primary data, findings and conclusion of the study represents distinctly the above stated sub-geres alone.

1.8 Organization of the study

This paper of the study comprises five chapters. The Chapter one is the introduction part of the study and consists of the background of the study, statement of the problem, the research questions, objectives, significance, delimitation, limitation and organization of the study. While, chapter two is only the review of the related literatures to wheat production pattern of farm households. The chapter three includes research methodology which are consists of sampling technique, method of data analysis, and the reference of external data. The Chapter four includes the discussion of collected data and results of analysis. Finally, the remaining Chapter five encompasses conclusion and recommendation part of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter presents a theoretical literature, empirical review which is a summary of previous related studies and various literatures on the research problem areas. The available literature is aimed to review empirical evidences to answer the research questions and identify the gap of challenges and opportunities of irrigated wheat production.

2.1 Introduction

Wheat (Triticum aestivum L.), a staple of diets across the globe, holds a paramount status among grain crops, boasting a larger cultivation area than any other agricultural commodity. With its adaptability to diverse climates and soil conditions, wheat thrives in various regions, contributing substantially to food security and livelihoods. Wheat plays a pivotal role in shaping societies, economies, and culinary traditions, embodying the essence of agricultural heritage and global interconnectedness (Kiss, 2011).

Wheat stands as a cornerstone of agriculture in Ethiopia, emerging as one of the foremost cereal crops cultivated across its fertile landscapes. Within the Sub-Saharan African region, Ethiopia proudly claims the second-largest area dedicated to wheat cultivation, underscoring its pivotal role in the nation's agricultural tapestry (Menna *et al*., 2015).

The goal of Ethiopia's Wheat Production Initiative was to increase the nation's ability to produce wheat on its own. Ethiopia anticipated harvesting 160 million quintals of wheat by the end of July, of which 52 million would be produced through irrigation. Ethiopian farmers cultivate both bread and durum wheat; bread wheat, also known as common wheat, makes up more than 90% of the nation's wheat output. The majority of the country's wheat is grown in the highlands in the center, south, and west; however, there is no or very little production of wheat in the lowlands. While production and productivity increased at average yearly rates of 8.75 percent and 5 percent, respectively, wheat area coverage significantly increased from 1,696,082.59 hectares in 2016 to 1,897,405.05 hectares in 2020. The largest amount of area cultivated is allocated for wheat production which is not a guarantee to reduce the wheat yield gap in Ethiopia (Zewdie, 2022).

Ethiopia is one of the mostly agricultural sector dependent economic countries in the sub-Saharan Africa with a small industrial and service sector in most recent. The share of agricultural sector employment is very high, large amount of its population living at subsistence levels and dependent on farm production, which is highly vulnerable to severe droughts for several times over the past 30 years (Abduselam, 2017). Ethiopia's agriculture is mainly relies on rain-fed farming practice and that contributes around 46.3 percent to overall GDP, 83.9 percent of export earnings, 80% of total employment (Zerihun, 2012), and supplies 70 percent of country`s raw materials to the secondary activities (MOFED, 2008).

Due to its size, the influence of agriculture on the economy has been extensive. The rain-fed nature of agriculture underlines the importance of the timing and amount of rainfall that occurs in the country (Cheung *et al*, 2008). More than 41 percent of the Ethiopian population lives below the poverty line and above 31 million people are undernourished; their majorities reside in rural parts of the country.

The current phenomena of El Niño drought conditions led to a sharp deterioration in food security; the estimated number of food insecure people was 4.5 million due to this vulnerable shock in August 2015, and by the end of the same year, this figure had more than doubled. (Abduselam, 2017). It is clear from the previous section that cereal production in Ethiopia fairly diversified.

According to FAOSTAT data, maize has been the largest cereal crops since the 1990s: its production has increased from an average of 2.3 million tons in the 1990s to 3.2 million tons in the early 2000s. Production of other major crops has increased as follows: teff production from 1.6 million to 2.0 million tons; wheat production from about 1.0 million to 1.9 million tons; and sorghum production from 1.2 million to 1.8 million tons. With an average production of 3.2 million tons in the 2000s, maize is the largest cereal crop in the country, followed by teff (2.0 million tons), wheat (1.9 million tons), and sorghum (1.8 million tons) (see table 1). Note that production of all major cereals has increase over the past two decades in the country, which is perhaps a reflection of heavy policy emphasis on cereals. Largest production growth observed for wheat, which has almost doubled.

2.2 Major Wheat Production Systems

According to Tadesse *et al*., (2019), Wheat is one of the most widely adapted crops grown at different altitude ranges. Though there are high degrees of environmental variations within and between regions, based on moisture availability, cropping systems and temperature regimes, the wheat production in Ethiopia can be divided into two major production systems: (i) Rainfed and (ii) Irrigated production systems.

2.2.1 Rain Fed Production System

The rain fed production system exists dominantly during the summer autumn seasons in the highlands and mid altitude areas of Ethiopia across the different regions and it was the only system of wheat production up until recently. The wheat cultivation system in Ethiopia is a combination of traditional and modern practices. Most of the smallholder farmers use oxen for ploughing, inputs (quality seed, inorganic fertilizers, herbicides, and fungicides), labor for weeding, sickles for harvesting and animals for threshing followed by winnowing using local tools and labors (Shiferaw *et al*., 2013).

The harvested grain is stored for local consumption and the straw is used for animal feed. Surpluses are marketed through nearby outlets. However, the productivity of such system is usually low and depends primarily on the availability of rainfall. Mechanized wheat production is implemented through cluster farming which is a mechanism whereby farmers willingly cluster their farms and adopt the same technological inputs including use of machineries such as tractors, planters and combine harvesters. The approach of cluster farming is increasing in many parts of Ethiopia and has contributed for better adoption of mechanization and inputs (seeds, fertilizers, chemicals etc.) and improving productivity. Different crop rotations such as legume-wheat, potato-wheat, or oil crops -wheat have been widely practiced in the rain fed production system for the various known advantages including improving soil fertility by fixing atmospheric nitrogen, enhancing water use efficiency (WUE), diversification, and breaking the cycle of weeds, insect pests and diseases (Braun *et al*., 2010).

However, wheat after wheat production (mono-cropping) becomes widely implemented in those areas where mechanization has been widely adopted. Farmers in those areas do not want to grow

legumes or oil crops in the rotation since there are no combine harvesters specific to these crops in addition to their low yield levels.

2.2.2 Irrigated Wheat Production

Ethiopia is one of the countries in Africa with huge potential for irrigated wheat production. Though traditional small-scale irrigation has been implemented for thousands of years, the Ethiopian agriculture has been fully dependent on rains until recently (Awlachew, 2022). Ethiopia has a potential of 5.3 million hectares of land suitable for irrigated agriculture using surface, ground and rainwater sources. However, only less than 2% of this potential has been utilized to-date (Gebremedhin and Asfaw, 2022).

Medium and large-scale irrigation schemes installation started in the 1950's and continued during 1970's especially along the Awash River basin and expanded recently along the Omo, Genale, Tekeze, Tana Beles, Wabi-Shebele in Somali region and other river basins for the production of sugar cane, cotton and fruits and commercial crops. Research for irrigated wheat production was started as early as 1980s at Worer Agricultural Research Center by the Ethiopian Institute of Agricultural Research (EIAR). However, there was no irrigated wheat production in the region even though there have been irrigation schemes developed for cotton production. Surprisingly, there has been no thought by the cotton farmers for using such land for double cropping with wheat or other legumes after harvesting their cotton. Attention for irrigated wheat production was triggered with an attempt for off-season accelerated early generation seed production of stem rust resistant wheat varieties at Worer ARC initiated by the international Agricultural Research in the Dry Areas (ICARDA) and EIAR through the USAID supported wheat project in Ethiopia starting in 2008/09 cropping season.

During the subsequent years, heat tolerant wheat varieties of ICARDA origin have been tested and released by EIAR and demonstrations and out-scaling of such heat tolerant wheat varieties have been carried out in the Afar and Oromia regions in partnership with EIAR, MoA, farmers, and private sectors through the Technologies for African Agricultural Transformation (TAAT) project supported by the African Development Bank (AfDB). Following these eye- opening activities along with the huge demand for wheat and need for import substitution, the government of Ethiopia has prioritized irrigated low land wheat production as key strategy to

ensure national food security. To this end, in 2019 a plan has put in place to cultivate wheat in about 500,000 ha of available irrigable land along the Awash, Wabishebele and Omo rivers basins in the coming 5 years (EIAR, 2022).

In the year 2019/20, heat tolerant wheat varieties have been cultivated in about 21,000 ha along these three river basins under irrigation. In 2020/21, over 187,000 ha of land has been cultivated using heat tolerant wheat varieties in the same river basins. In the year 2021/22, more than 400,000 ha of wheat is being cultivated under irrigation across the entire country.

The average yield level of the heat tolerant varieties under irrigation ranges from 4–7 t/ha. Motivated and encouraged with these achievements, the government of Ethiopia has set a plan to expand irrigated wheat production to a total of 1.5 million hactares in the coming 5 years. However, it is highly important to adopt modern irrigation schemes such as drip irrigation, raised bed Plantings, crop rotation etc in order to minimize the risk of salinization and increase water use efficiency and productivity. In the irrigated environments, wheat-rice, wheat-legumes, wheat sesame or wheat-cotton rotation systems are practiced by growing wheat in the winter season. In the wheat-cotton rotation system, harvesting of cotton is delayed up to late October which pushes the wheat planting date to the last week of December. Such delayed planting of wheat exposes wheat to heat stress in March during grain filling period causing not only reduction in wheat yield but also reduction in wheat grain quality (CSA, 2020/22)..

Development and out-scaling high yielding and early maturing varieties of both crops is very important for the practical implementation of such double cropping system. Irrigated wheat production in the off-season in mid- and high-altitude areas could be affected by pre-harvest sprouting since most of these areas experience rainfall during March/April. Hence, it is highly recommended to map irrigated wheat production environments in the country and follow strict crop operation calendar so that double cropping is practiced, and maximum profitability of the system is achieved sustainably (Tadesse *et al*. 2022)..

2.3 Challenges to Wheat Production

Wheat production in Ethiopia is constrained by several abiotic and biotic stresses at different levels of intensity across rain fed and irrigated environments. This is further heightened by increasing occurrence of climate change which is characterized by rising temperature (heat), less

and erratic rainfall (drought) or sometimes excessive rainfall (flooding) and emergence of virulent pests and diseases and also bird attack is one challenge (Lemi, 2014). The most important challenges for wheat production in Ethiopia are summarized below.

2.3.1 Biotic Stresses

The most important biotic constraints which affect wheat production in Ethiopia include diseases, insects and weeds. Rusts (Puccinia spp.), Helminthosporium, septoria (Septoria tritici), tan spot (Pyrenophora tritici repentis), fusarium (Fusarium spp.), as well as smuts, take-all, and root rots are important wheat diseases common in the highlands of Ethiopia. Associated with the current climate change effects, virulent stem rust strain of Ug99 and temperature tolerant yellow rust races have caused epidemics in Ethiopia (Solh *et al*., 2012).

Yellow (stripe) rust caused by Puccinia striiformis f. sp. tritici is the most prevalent and devastating disease in Ethiopia and other east African highlands. It has caused significant yield losses reaching up to 100% in the Ethiopian highlands as evidenced by the collapse of the dominant wheat varieties such as the semi-dwarf wheat variety Laketch in 1977; Dashen, a poplar high yielding variety with Yr9 gene from 1B/1R translocation in1988 and in 1994; and in cultivar Wabe in 1998 (Badebo *et al*., 2008).

Similarly, the two high yielding wheat varieties with Yr 27 gene (Galema and Kubsa) were dominantly cultivated for more than 15 years until they became 100% susceptible in 2010 and banned from production. Stem rust caused by Puccinia graminis f. sp. ttritici is prevalent in the low and mid altitude areas of Ethiopia with warmer temperature. It has knocked out major cultivars such as Enkoy with Sr36 gene in 1994; and Digalu with SrTmp+ gene in 2013 and 2014 resulting total crop failer . The Digalu race (TKTTF) which is different from the Ug99 race (TKTTSK) is dominant across the major wheat growing regions of Ethiopia (Badebo *et al*., 2008) and became a major threat to wheat production in the country.

2.3.2 Abiotic Stresses

In the rain-fed environments, the most important abiotic stresses are drought, (especially in the lowlands), soil acidity, erosion, poor soil fertility, water-logging, and pre-harvest sprouting. Such constraints are most common in highlands of Ethiopia. The total rainfall in the wheat growing

areas ranges from 600–1200 mm. Such problems are common in the high lands. The main problem associated with rainfall is not the total amount, but the uneven distribution which affects the crop production calendar, productivity and the grain quality when it rains at maturity stage of the crop (pre-harvest sprouting). Soil acidity is one of the most important constraints affecting about 6.3 million ha 43% of the arable land area in Ethiopia Efforts have been made to mitigate soil acidity through the application of liming. However, acid soils require large quantity of lime and it quickly become a very bulky affair as there is a need to apply 2 to 3 t/ha for sandy soils and up to 5 t/ha for clay and humifere soils (Mosissa, 2022).

Heat, salinity and inefficient use of irrigation water are the most important abiotic constraints in the irrigated environments. Germination of wheat within the grain head before harvest is called pre-harvest sprouting (PHS). It is a major problem both in rainfed and irrigated environments when there is prolonged rainfall at crop maturity before harvest. Such seed have a very poor rate of germination and hence it is not suitable for planting in farmers' fields. Furthermore, water absorption capacity and bread making quality of the flour from such sprouted wheat harvest is extremely poor as indicated by the 'falling number test' which measures alpha-amylase (an enzyme that breaks down starch within germinating seeds activity within a grain sample(Zhang *et al*. 2022).

Falling number (FN) tests are conducted by creating a slurry of flour and water in a test tube and measuring the time required in seconds for a weighted plunger to fall through the slurry. Wheat flour affected by PHS results in high α-amylase activity, low FN values (less than 250), poor rheological and cooking properties including poor quality for mix ability, crumb strength, and loaf volume (Dencic *et al*., 2013). It is important to develop varieties with certain level of grain dormancy which are tolerant to pre-harvest sprouting. Wheat varieties with red seed coat grain have high level of dormancy and hence high level of tolerance for pre-harvest sprouting.

2.3.3 Limited Availability and High Price of Inputs

Wheat production in Ethiopia is dominated by subsistence farmers and its productivity is still very low partly due to the limited availability, accessibility and affordability of inputs such as fertilizers, improved seeds, irrigation water, pesticides and farm machineries (Anteneh&Asrat, 2020).

Fertilizers are imported and hence the cost increases with the energy prices and global demands. Furthermore, accessibility for transportation and its cost along with access to credits affect timely distribution of fertilizers to farmers. Water availability and installation cost for irrigation schemes are limiting factors to expand wheat production in the irrigated environments. The irrigation schemes are along the main river basins (Awash, Wabe Shebele, Omo, and many other medium size rivers) which are filled through rains. Ethiopia has a huge rain water potential (estimated up to 1 trillion m3) (Anteneh&Asrat, 2020). The rivers are full to the maximum causing damage through excessive flooding during the summer (rainy season). The main challenge for the country is resource limitation to build dams, canals and related structures and facilities for modern irrigation schemes. The current furrow/flood irrigation system utilized by farmers is not effective and sustainable in terms of water use efficiency and controlling salinity.

2.3.4 Yield Gaps and Stagnation

Yield stagnation is the level where crop productivity reaches at its maximum ceiling due to genetic ceiling in the crop breeding programs, unfavorable factors such as biotic and abiotic stresses, climate change, and unproductive policies along the whole value chain. Some authors have attributed yield stagnation to the genetic ceiling in India and Europe while others have reported the presence of genetic gain in both spring wheat and facultative winter wheat (Sharma *et al*., 2012).

However, it is evident that the potential of new cultivars has not been fully utilized in most of the developing countries due to poor agronomic management, partial application of packages of inputs, reduced incentives and unstable market prices resulting in huge yield gaps.

According to Tadesse *et al*., (2013) wheat yield gap levels ranging from 26–69% at global level. However, the gap remains high especially in developing countries due to lack of knowledge and information reflecting on the performance of extension services and seeds/inputs delivery systems and poor infrastructures. In Ethiopia, progressive farmers could harvest 7t/ha under favorable rain fed environments and 8 t/ha under irrigated environments while the national average yield is about 3.1 and 4.4 t/ha under rain-fed and irrigated environments indicating the presence of 44.3 and 55% yield gaps, respectively.

2.3.5 Infrastructure and Policies

Agriculture policies on: (1) land use and tenure (2) technology development, shopping, testing and adoption (3) subsidies (4) inputs,marketing and distribution (5) taxation (6) infrastructure and human capital development (7) public-private-partnership, etc. do play significant roles in improving agricultural productivity, and social welfare development in Ethiopia. These policies should be flexible enough to accommodate improvements whenever needed to adapt changes within the country, regionally and globally. Low public and private investments, weak extension systems, weak market and infrastructure linkages etc. remains to be the major challenges for wheat production in Ethiopia (Anteneh & Asrat, 2020).

Limited rural road networks and transportations not only limit access to agro-inputs (seeds and agro-chemicals) by farmers, but also limits aggregation, storage and transportation of wheat grain to markets. Shortage of power/energy affects development of agro-processing industries, irrigation schemes, and technology development. Therefore, it is important to unlock the key policy and regulatory challenges that constrain technology development, access and deployment; contract farming, innovative financing, public private partnership, and integrated wheat production, marketing and agro-processing for the success of the wheat industry in Ethiopia.

2.3.6 Bird attack

Bird attacks on wheat production can have significant economic and agricultural ramifications. These attacks typically involve birds such as sparrows, starlings, and blackbirds, which can flock to wheat fields in large numbers and cause extensive damage to the crops. They peck at the grains, consume young shoots, and can trample plants, leading to reduced yields and quality of the harvested wheat (Singh *et al*. 2021).

According to John *et al*., (2018), bird damage to wheat crops accounted for an estimated 5-10% loss in global wheat production annually. The study highlighted the importance of implementing effective bird deterrent measures and promoting sustainable agricultural practices to mitigate these losses.

2.3.7 Unseasonal rain

Unseasonal rain presents a formidable challenge to irrigated wheat production in developing countries like Ethiopia, disrupting the carefully managed water supply systems and agricultural schedules. Unlike regions with predictable precipitation patterns, where irrigation can be optimized to supplement natural rainfall, developing countries often grapple with erratic weather conditions that can lead to both droughts and unanticipated rainfall.

Unseasonal rain poses a dual threat to wheat production. It causes waterlogging and saturation of the soil, leading to oxygen deprivation in the root zone and impeding plant growth. Excessive moisture can also promote the proliferation of fungal diseases such as Fusarium head blight and root rot, further compromising crop health and yield potential (Singh *et al*. 2017).

2.4 Opportunities of the Irrigated Wheat Production

Even though there are a lot of constraints that limit the production and productivity improvement of irrigated wheat production in Gelan Guda, there are a lot of opportunities that encourage farmers, government organization and policy makers to continue the production. Some of the opportunities but are not limited to are as listed below.

- Availability of water resources and irrigable land.
- High government attention and involvement for the production of irrigated wheat.
- Increment of the farmer′s awareness on the production and productivity improvement of irrigated wheat.
- High demand of wheat from the consumers and increase of the market cost additionally, there are food processing industries constructed in the zone and nearby areas which demand wheat and this opportunity create a market access and enhance the market cost.
- There is a strong interest from Agricultural researchers to study and contribute new research and improve the previous work for the production and productivity improvement through the supply of improved seed, irrigation technology, efficient nutrient management, suitability of the land and respective irrigation method to be adapted.

- Expansion of urbanization which demands agricultural production is also an opportunity for the production of irrigated wheat (Ashine, 2023).

2.5 Empirical Literature Review

This section contains reviewed literature that was relevant to this study. Literature reviewed show that, there have been studies done on challenges and opportunities of irrigated wheat production. However, since this is new government initiation not much has been done in terms of research in the area.

Dube *et al*. (2020) tried to identify Irrigated wheat production constraints and opportunities. The study result shows the dominant constraint to yield was identified as the low market price for grain, which makes farmers reluctant to invest in inputs for increasing wheat yield. Poor cultivar choice, cereal-based mono-cropping, the high cost of irrigation, inadequate irrigation water, low crop stands, soil acidity, no-till practices and red-billed quelea (*Quelea quelea*) birds are negatively impacting yields.

Ashine, (2023) conducted the study on identifying the major challenges for the production of irrigated wheat in Jimma zone. According to his study result, land for irrigated wheat farming, limited agricultural inputs, in adequate and low performance of small scale irrigation schemes, disease and pest problem, lack of market access, lack of financial support for irrigated wheat, and low quality of wheat products are challenges of wheat production. Availability of water resources and irrigable land and high demand of wheat from the consumer side are among the opportunities that encourage farmers and other stakeholders to involve in the irrigated wheat production in Jimma Zone.

According to Terefe (2018), the main obstacles to the production of wheat, maize, and teff are disease and crop worms, Lack of inputs, including chemicals, fertilizers, seeds, etc., and price issues. High post-harvest losses, a dearth of farmed cattle, a lack of rural credits, a lack of knowledge, and a lack of rural feeder roads are all contributing factors. The availability of fertile soil, irrigable land, motivated and industrious farmers, the placement of the districts for agricultural marketing, and favorable weather were determined to be the main opportunities in the research area.

Tadesse *et al*. (2022) conducted a comprehensive study on wheat production and breeding in Ethiopia. Their findings highlight significant challenges, including biotic stresses such as yellow rust, stem rust, septoria, and fusarium, alongside abiotic stresses like soil acidity, heat, and drought. Additionally, the study identifies substantial yield gaps due to the low adoption of new technologies, high costs, and limited availability of inputs. Furthermore, the study identifies inadequate public and private investments, coupled with poor infrastructure and inefficient marketing systems, as critical barriers to wheat production.

2.6 Literature Summary on Gap

Various studies have been conducted to identify wheat production challenges and opportunities in developing countries including Ethiopia. Ashine, (2023) tried to identify the existing challenges and opportunities related to irrigated wheat production in Jimma zone, where there is no challenges like unexpected floods. This indicates the absence of clear recommendations about the negative impact of floods. Degefa, (2023) also conducted the research on assessment of irrigated wheat in western oromia. This study also ignored to include some important irrigated wheat production challenges. Nigus, 2022) conducted the research on related titles only by focusing on challenges and coping strategies of rust disease without giving focus attention for major challenges of irrigated wheat production in off season. Therefore, this study was gives a major concern to identify the major challenges of irrigated wheat production in Gelan Guda district to forward valuable, area specific recommendations for the government, non-government and farmers in order to fill the knowledge gaps. More over this study also identified area specific opportunities of irrigated wheat production.

2.7Conceptual Framework

The proposed framework for this research is illustrated in Figure 2.3. It shows challenges and opportunities of irrigated wheat production on small holder farmers.to increase the productivity first identify the challenges, work on challenges and use the opportunity in the research area.

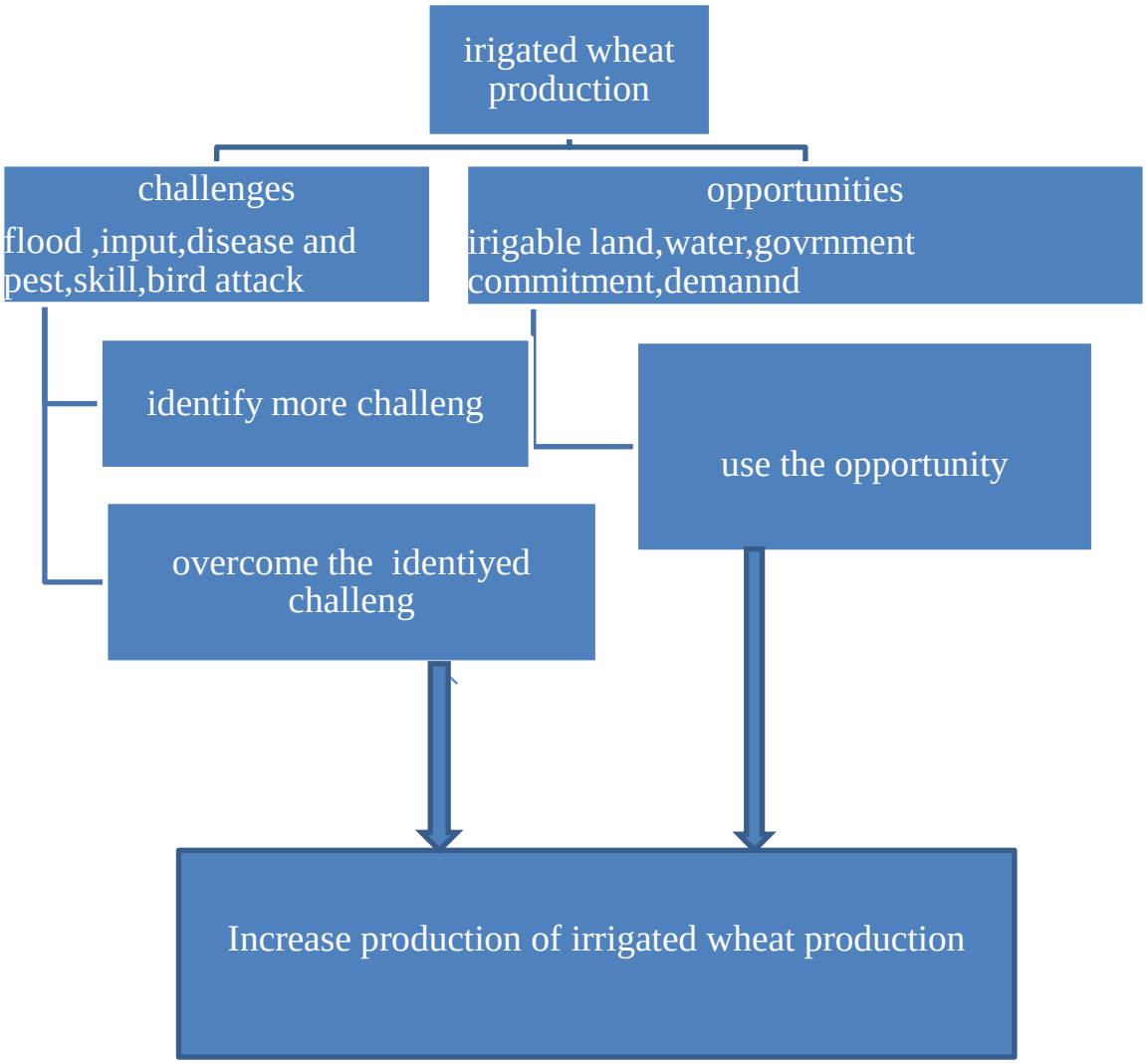


Figure 1: conceptual frame work

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter, In order to achieve the objective of this paper, using of appropriate methodology that helps to approach the research scientifically is the priority attention given by the researcher. Therefore, it includes description of study area, research design, research approach, population and sampling technique, instrument for data collection, procedure of data collection and method of data analysis.

3.1 Description of the study area

Gelan guda sub city is one of twelve sheger city administrations in Oromia region. The city is located at a distance of 8-20 km (to the west) from Addis Ababa. The city has three District named as, Daleti,lekule geja and gelan guda district. Specifically the research area was gelan guda district. The district has 8 zones and 10 Gere. The total irrigable land coverage of the District is 15000-20000 hectares. The livelihood source of the population is crop production, livestock and vegetable production.akakela river is their water source for crop and vegetable production.

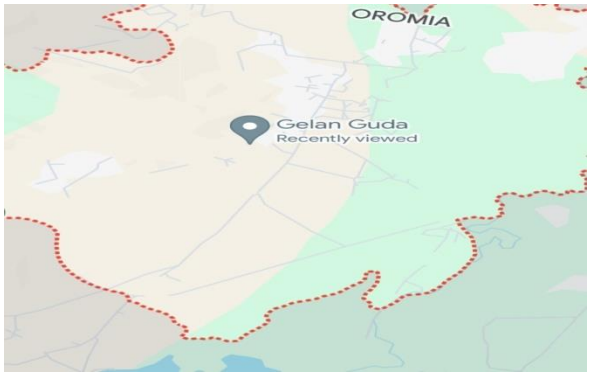


Figure 2: Location of the Study Area

3.2 Research Design

The research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement, and analysis of data (kothari, 2004).

In other ways, its plan specifying the methods and procedures for collecting and analyzing the needed information. In this study the descriptive and explanatory research design method has been used to describe, record, analyze, and interprets the nature of the problem understudy in its current status. In a descriptive research design the researcher has no control over the variables. Explanatory research attempts to simplify a relationship between two or more aspects of a condition or phenomenon. Explanatory research tries to seek out explanations of observed phenomena, problems, or behaviors. It attempts to identify causal factors and outcomes of the target phenomenon (Biset Amene & Yadessa, 2018).

3.3 Research Approach

This research focused on a mixed approach of using both quantitative and qualitative research for a better understanding of the challenges and opportunities of irrigated wheat production in the case of Gelan Guda wereda. According to Biset & Yadessa (2018), Qualitative data was appropriate since meanings were based on expressions through words, and analysis was conducted through the use of conceptualization. The qualitative analysis aims to collect an in depth understanding of human behavior and so reasons that govern such behavior. The researcher also uses this approach to fill the gap that has not been covered by the quantitative approach. Quantitative data is numerical data or data in the form of numbers that have been analyzed by using statistical techniques. Quantitative research discusses the systematic empirical investigation of quantitative properties and phenomena and their relationship.

3.4 Data Types and Sources

Both quantitative and qualitative types of data were collected from primary and secondary sources to examine the challenges and opportunities on irrigated wheat production farm household. The primary data was collected from selected small holder farmers involved in the research through direct personal observation method, and survey or questioning by using semi-structured questionnaire. The secondary data was acquired from various sources such as department reports, production summaries, studies, books, university publications (thesis, dissertations, etc.), research report, proceedings, the internet, etc. The main types of data collected for this study include small holder farmer's demographic characteristics, challenges, opportunities and income from wheat yield by the households in a specific period.

3.5 Target Population

Garson (2012) defines population as "the entire set of individuals, events, or items of interest that the researcher needs to study". So as to perform this study, the first step was to get the total number of populations. The target populations of Gelen Guda wereda , Currently the wereda had 150 small holder farmers in three geres (meteli,buludo & akindo) 47,50 and 53 respectively concerned with irrigated wheat production .The study was undertaken so as to draw the sample from these total population.

3.6 Sampling Technique

This research data was collected by sampling survey method, because to obtain consistent and unbiased estimates of the population parameters, resource limitations and large population size. Then cross-sectional survey design was used, because to collect data at one point in time. One types of sampling methods employed to select sample. The random probability sampling technique used to draw a sample. The study zone gelen guda was selected. In case of major irrigated wheat-producing area from three rural districts in the zone. Then, three sub-gere were selected purposely from six gere in consideration of agro-ecologically suitability for irrigated wheat production. Next, in the random probability technique by using simple random sampling method three sample gere were selected. Then the sample of elements or small holder farmers has drawn from villages by using systematic sampling technique.

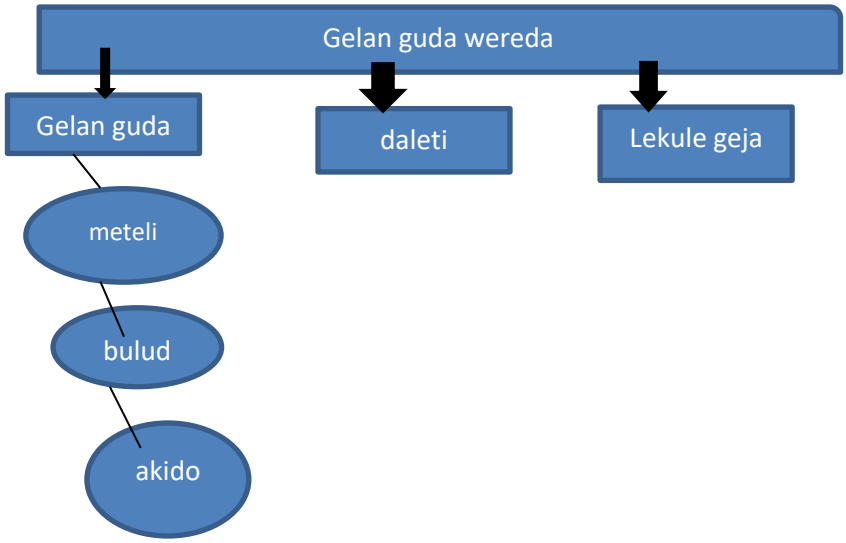


Figure 3: The Sample Frame, Sample Size and Methods to Select

There were different possible ways of sample size determination with different approaches in determining error terms and precision levels. While calculating the published tables as a guide for sample size determination, Israel (1992) had used a formula developed by Yamane (1967) with the precision level of ± 3, ±5, ±7 and ±10. Therefore, due to this and the commensurately known use of precision levels starting from ±1 to ±10 (because of the target population is homogenous), then for sample size used Yamanes' (1967) formula with a precision level of ±5. About 109 sample size respondents were selected from the three geres by using Yamane sample calculation formula (e=5%). The number of sample households chosen from each gere was proportional based on the total number of households in each gere with 95% confidence level. The Yamane formula for determine the sample size given by:

-n=N/ (1+N (e2))

Where n= corrected sample size, N = population size, and e = Margin of error (MoE).

n = N/(1+N(e)2.

n = 150/(1+150(0.05)2.

n = 150/(1+150(0.0025).

n = 150/ (1+0.375).

n = 150/ 1.375

n =109

Table 1: Sample geres and sample size in study area

	Gelan Guda			
Code	Gere	No SMHF in gere		Sample size
1	Meteli	47		35
2	Buludo	50		37
3	Akido	53		37
Total		**150**		**109**

3.7 Methods of Data Collection

The Primary data was collected through questionnaire, observation and interview. Survey or questioning data collection carried out through face-to-face personal interview and checklist developed to collect general information from sample key informants and focus group discussions. Information on challenges (bird attack, flood, input and market) crops harvesting period market price pattern and the effects on farmers' income status also collected. The data collected by visiting each one of the sample households including personal observations.

Secondary data on the other hand are those which have been already collected by someone else and which have been passed through the statistical process. E.g. books, magazines, internet, publications and reports.

Focus group discussions

In addition to the information collected through the individual survey, questionnaires and key informant questionnaire focus group discussions was used in each of the sample gere (gende) level to get the general picture regarding the to identify the major challenges of irrigated wheat production. In each FGD, 5 members (old, young, male and female) of the society were selected at each gere. All of them selected after discussion with other pertinent key informants in the gere particularly with gere leaders.

3.8 Methods of Data Analysis

After the completion of the household survey, the data processing and analysis took place. The data processing started with the editing, coding, classifying and tabulation of the collected data on the bases of homogenous groups or common characteristics. Then by using descriptive analysis method the processed data was analyzed exhaustively.

3.9 Reliability and validity

In order to ensure validity, the researcher consulted his supervisor, who reviewed the questionnaires and provided professional opinion on whether the instruments were capable of measuring the intended subjects. It focuses on how many questions there should be in order for answers to aid in making conclusions.

According to Mugenda (2003), validity establishes whether the study measures what it was supposed to assess and how accurate the findings are. Every participant in this study answered the identical items derived from the same interview guide. To avoid a language barrier, all questions were asked in the local lounguage, as the majority of participants spoke it well. In order to ensure that the participants fully understand the questions, clear and concise explanations. The questionnaire was organized and finalized with a close consultation of my advisor and expertise of the subject. To address Ambiguous claims, same spirited questions were forwarded to Key informant participants for triangulation purpose. Furthermore, secondary documentations were reviewed to verify factual claims made by respondents.

3.10 Ethical consideration

Ethics refers to the appropriateness of the researcher's behavior in relation to the rights of those who become the subject of the research work, or are affected by it. Research ethics therefore relates to questions about how we formulate and clarify our research topic, design our research and gain access, collect data, process and store our data, analyze data and write up our research findings in a moral and responsible way (Saunders *et al*,. 2009).

In conducting this research, the privacy of participants has been kept, and it's made known to every participant that the nature of participation was voluntary. The confidentiality of data and the participants' anonymity is maintained. The researcher takes in to account the issues of

feasibility and sufficiency in relation to gaining access to data and the impact of these on the nature and content of the research questions and objectives.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter presents the data analysis, discussion and interpretation of the research findings. The data analysis was made with the help of Stata and Microsoft excel. The first part of the chapter discussed about the demographic profile of the study sample, responses received. The second part is about the distributed and returned questionnaires about small holder farmers have been described using descriptive statistics.

4.1 Demographic characteristics of the respondents

4.1.1 Age of the respondents

Table 2: Age of the respondents

Age	Freq.	Percent	Cum.
Below 30	15	13.76	13.76
31-40	38	34.86	48.62
41-50	36	33.03	81.65
Above 50	20	18.35	100.00
Total	109	100.00	

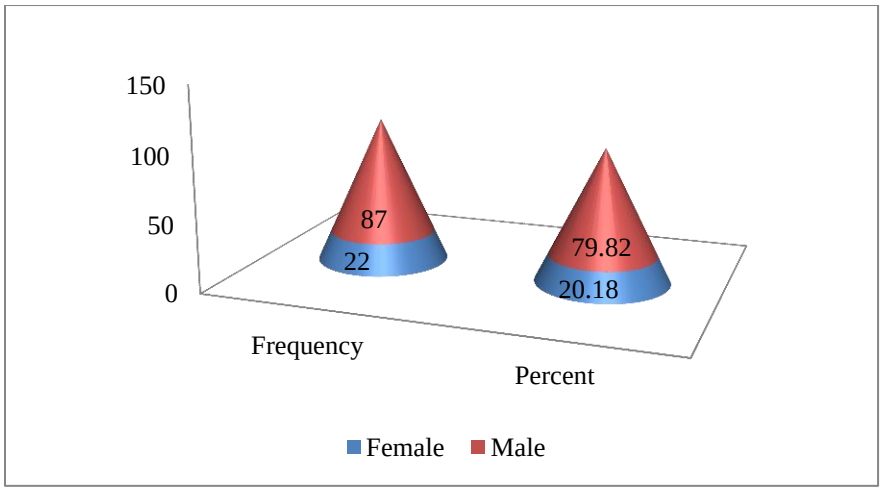
Source: own survey result, 2024

Age distribution in table 2 indicates out of total sample respondents, the majority of them 38(48.62%) were aged from 31-40. The table also shows 33.03%, 18.35%, and 13.76% of the respondents was aged from 41-50, above 50, and below 30 respectively. This result confirms majority of irrigated wheat producers in the district were economically active.

4.1.2 Sex of the respondents

The chart below indicates 87(79.82%) of the irrigated wheat producers were male, While 22(20.18%) were females. This confirms the majority of irrigated wheat producers were male headed households. This may be because of many responsibilities of females in household.

Figure 4: Sex of the respondents



Source: own survey result, 2024

4.1.3 Marital status of the respondents

Table 3: Marital status of the respondents

Marital status	Freq.	Percent	Cum.
Married	73	66.97	66.97
Single	18	16.51	83.49
Divorced	9	8.26	91.74
Widowed	9	8.26	100.00
Total	109	100.00	

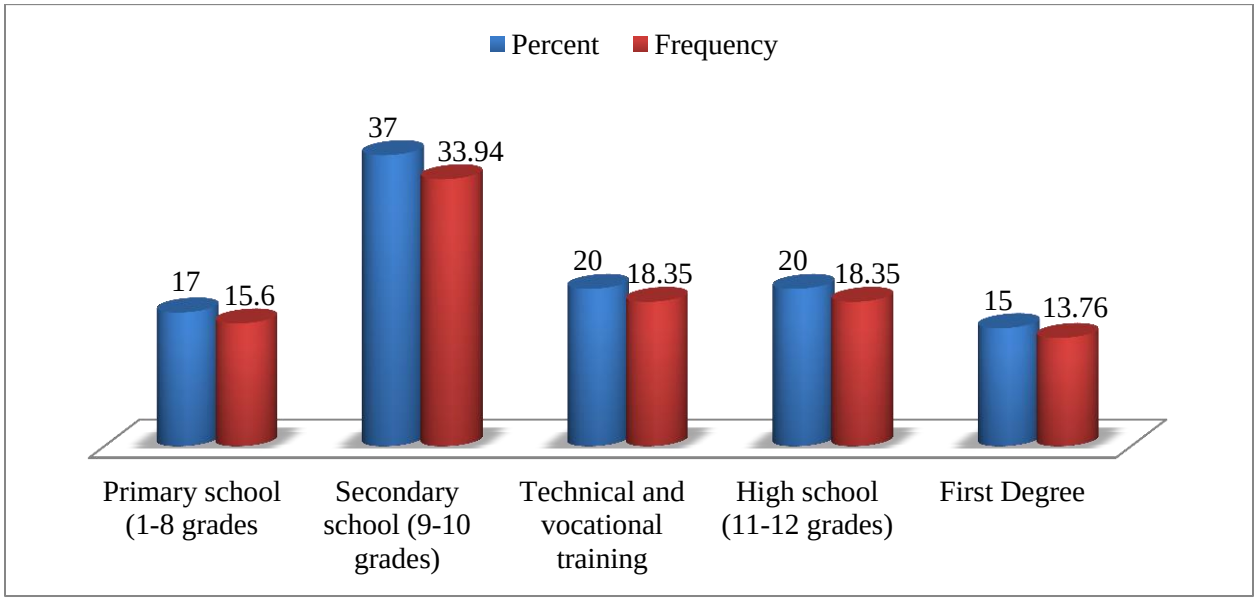
Source: own survey result, 2024

Based on the survey data results in table 3, majority (66.97%) of the respondents were married. While 16.51%, 8.26% and 8.26% of the respondents were single, divorced, and widowed

respectively. This shows married farmers were more participated in irrigated wheat production in the district.

4.1.4 Education level of the respondent

Figure 5: Education level of the respondent



Source: own survey result, 2024

As indicated in the above plot, education level of the majority 37 (33.94%) of irrigated wheat producers in the district was secondary school (grade 9-10). While education level of 18.35%, 18.35, 15.6% and 13.76% were technical and vocational training, high school, primary school, and first degree respectively. This indicates irrigated wheat producers in the district can read and understands irrigation related advices.

4.1.5 Farmers Livelihood sources

Table 4: farmers Livelihood sources

Livelihood source	Freq.	Percent
Crop production &vegetable farm	0	0.00
Livestock production	0	0.00
Crop, vegetable &livestock	109	100.00
Total	109	100.00

Sources: own survey result, 2024

The survey result of this study indicates livelihood sources for all of the sampled respondents were crop, vegetable and livestock production.

4.2 Participation status of the respondent in agricultural extension service

Table 5: Participation status of the respondent in agricultural extension service

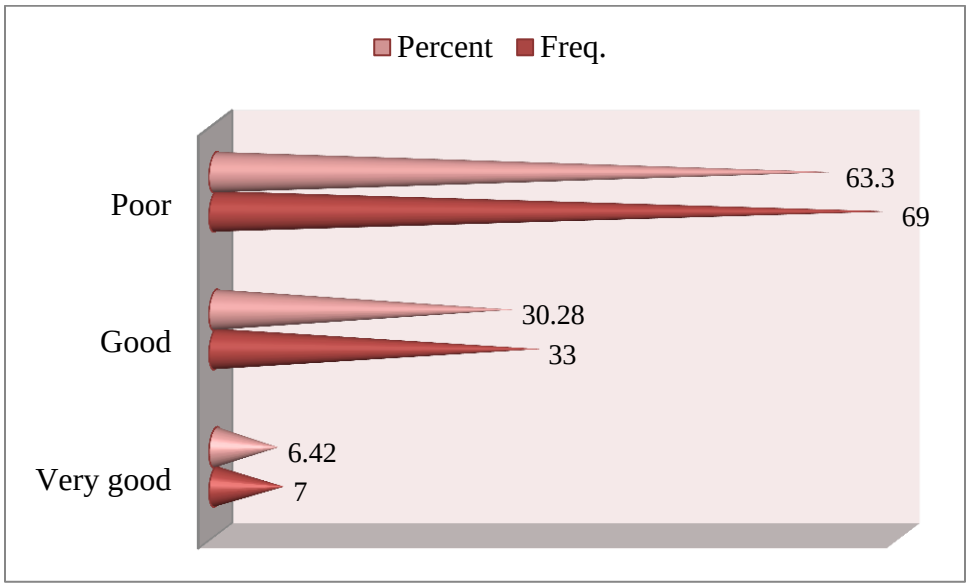
Participation	Freq.	Percent
Farmer Field visit day	94	86.24
Training	0	0.00
Workshop	0	0.00
Extension Meeting	15	13.76
Total	109	100.00

Sources: own survey result, 2024

Descriptive statistics result presented in table 5 indicates majority 86.24% of irrigated wheat producers in the study area were participated in farmers' field visit days, only 13.76% of the respondents participated in extension meeting related to irrigated wheat production in the study area. While none of respondents was participated in any kind of trainings and workshops related to irrigated wheat production in the study area.

4.3 Perceived yield evaluation

Figure 6: Perceived yield evaluation



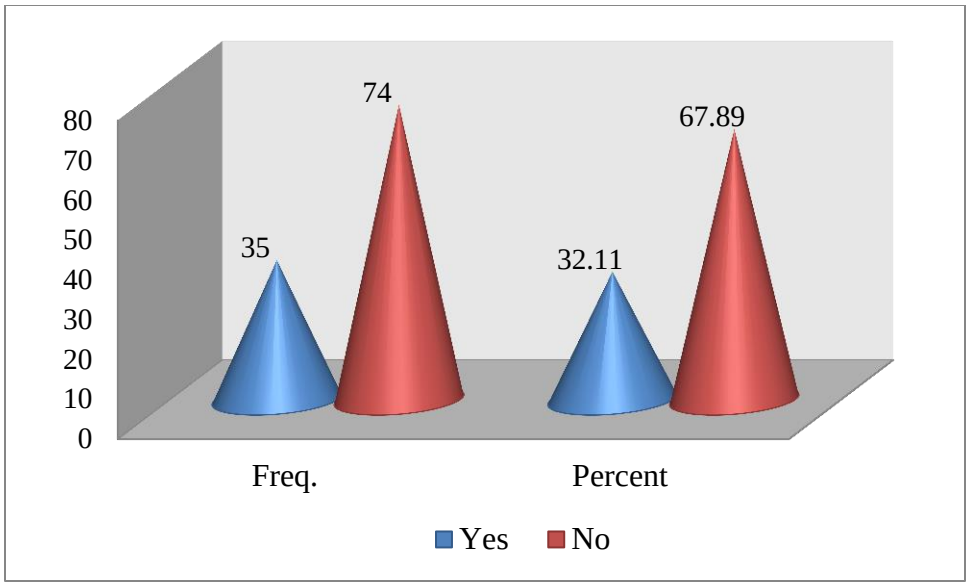
Sources: own survey result, 2024

The result of the study in the above plot revealed that the majority (63.3%) of irrigated wheat producers confirms the yield gained from irrigated wheat was poor. These shows there are different challenges that hinder irrigated wheat production. The yield gained from irrigated wheat was good for about 30.28% of the respondents while, the production was very good for 6.42% of the respondents in the research area. This indicates the existence of significant challenges in irrigation practices for wheat production.

4.4 Improved technology use

As indicated in char 4, the majority 74(67.89%) of irrigated wheat producers are non-users of improved agricultural technologies. Only 35(32.11%) of the respondents are the users of improved technology related to irrigated wheat production in the study area.

Figure 7: Improved technology use



Sources: own survey result, 2024

4.5 Irrigated wheat production of the respondents

Table 6: Irrigated wheat production of the respondents

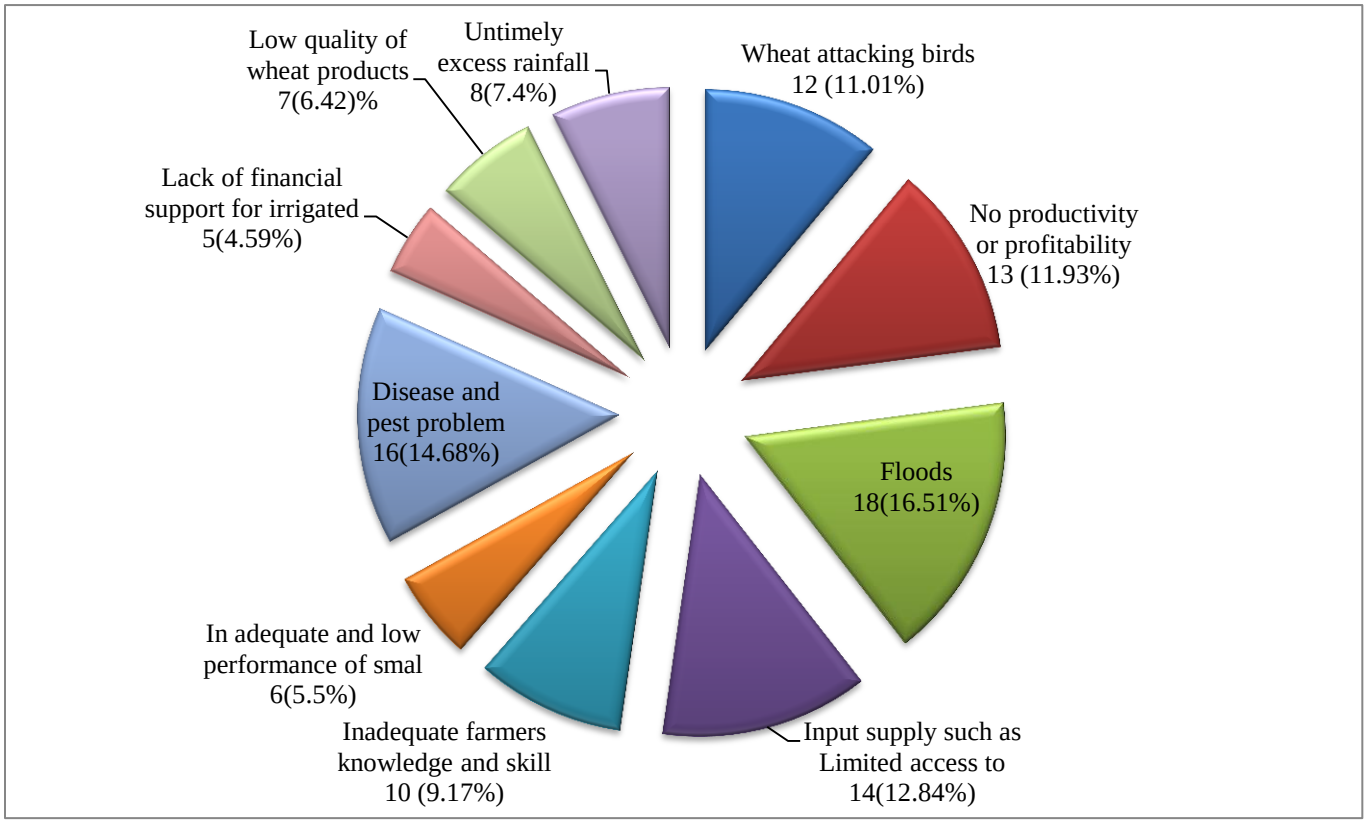
Variable	Observation	Mean	Std. Dev.	Min	Max
Total yield	109	9.788991	7.115546	0	27

Source: Own survey result, 2024

The result of this study shows that the average wheat produced by sample respondent in the study area was 9.78 quintals. The maximum irrigated wheat production was 27 quintals and the minimum was 0. The result shows the existence of high variation between maximum production and the minimum. According to information from focus group discussions wheat production was zero for some famers because of unexpected floods during harvest time (Table 5).

4. 6 Major challenges of irrigated wheat production

Figure 8: Major challenges of irrigated wheat production

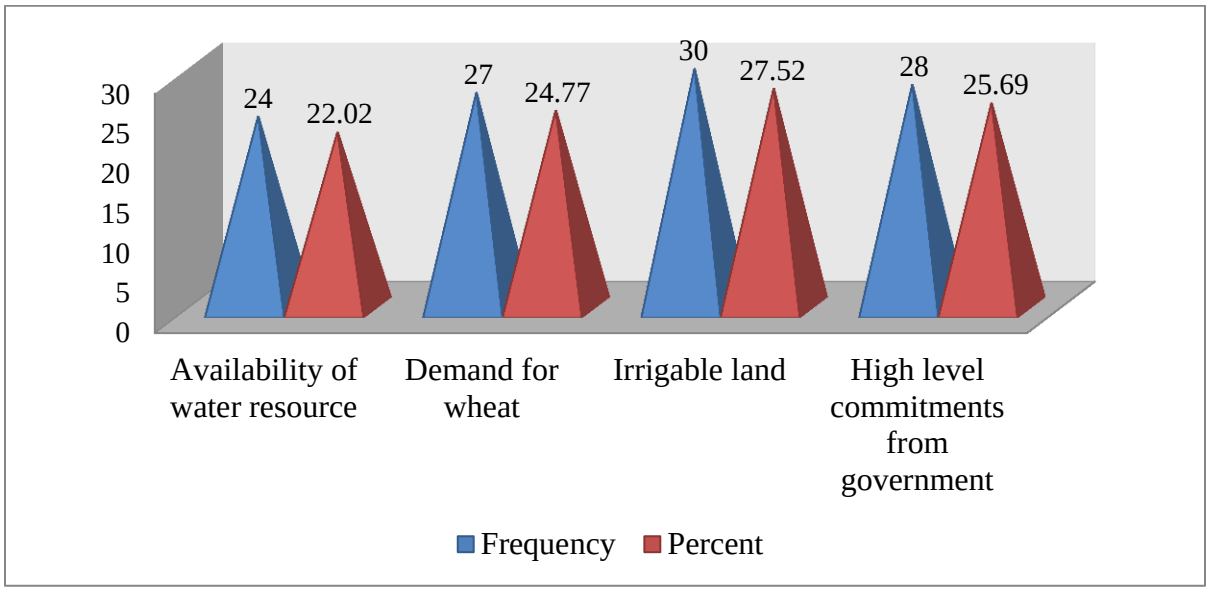


Source: own survey result, 2024

The descriptive statistics result presented in the chart 5 indicates different challenges of irrigated wheat production in the Gelan Guda district. The result of this study shows, floods (16.51%), disease and pest problem (14.68%), input supply such as limited access to quality seeds, fertilizer, and agrochemicals (12.84%), low productivity (11.93%), and wheat attacking birds (11.01%) are top five challenges of irrigated wheat production in the district. The reaming challenges such as inadequate farmer's knowledge and skill in irrigation management (9.17%), untimely excess rainfall (7.4%), low quality of wheat products (6.47%), inadequate and low performance of small scale irrigation schemes (5.5%), and lack of financial support for irrigated wheat (4.59%) are other challenges which hinder wheat production in the study area which are ranked from six to ten respectively.

4.7 Opportunities of irrigated wheat production

Figure 9: Opportunities of irrigated wheat production



Sources: own survey result, 2024

The descriptive statistics result in chart 6 confirms the existence of irrigable land 30(27.52%) in Gelan Guda district was the first ranked opportunity of irrigable wheat production. In the similar manner, high commitment from government (25.69%), demand for wheat (24.77%), availability of water resources are among opportunities of irrigable wheat production according to decreasing order.

4.8 Discussion

The age profile of the respondent confirms that the majority of irrigated wheat producers in the district are within the active age group, typically considered to be between 15 and 64 years. Guo et al, (2015) found the significant impact of farmer's age on agricultural output.

The study result indicates 87(79.82%) of the irrigated wheat producers were male, While 22(20.18%) were females. Study shows a gender disparity in irrigated wheat production, with 79.82% of producers being male and 20.18% female. This may be because of many

responsibilities of females in household. This highlights the need for gender-inclusive agricultural policies.

Based on the survey data results in table 3, majority (66.97%) of the respondents were married. While 16.51%, 8.26% and 8.26% of the respondents were single, divorced, and widowed respectively. A high percentage of married respondents could imply a level of social stability, as marriage often signifies a stable household arrangement which can have various socio-economic implications.

The livelihood sources for all of the sampled respondents were crop, vegetable and livestock production. As noted by Addisu, (2017), crop and livestock production was the main source of livelihood in Ethiopia. Descriptive statistics result presented in table 5 indicates majority 86.24% of irrigated wheat producers in the study area were participated in farmers' field visit days, only 13.76% of the respondents participated in extension meeting related to irrigated wheat production in the study area. While none of respondents was participated in any kind of trainings and workshops related to irrigated wheat production in the study area. This shows the need to enhance the availability and accessibility of structured training and workshops to improve knowledge transfer and farming practices among wheat producers. Assefa *et al*. (2014) also confirms the significant impact of information literacy of farmers on agricultural production. The majority (63.3%) of irrigated wheat producers confirms the yield gained from irrigated wheat was poor. The majority of respondnets were non-user of improved technology. According to Stellmacher & Kelboro, (2019) lack of technology adoption was the main cause of low agricultural production in developing countries.

The result of this study shows identified floods as number one challenge of irrigated wheat production. Following flood disease and pest problem, input supply such as limited access to quality seeds, fertilizer, and agrochemicals, low productivity, and wheat attacking birds are top five challenges of irrigated wheat production in the district. According to the studies conducted by Debelo, 2020; Bekabil, 2014; and Faure et al. 2012) indicates the existences of challenges of agricultural productions in developing countries.

As noted by Yigezu, (2021) there are many challenges that hinder agricultural production. On the other hand there are opportunities. The current study identified the existing opportunities for

irrigated wheat production in the study area. One of the major opportunities was the availability of irrigable land, which can significantly enhance wheat production through irrigation. Additionally, high government commitment, increasing demands for wheat, and the availability of water resources were identified as key opportunities for expanding irrigable wheat production. These factors collectively present a promising potential for boosting wheat yields in the region.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summaries of the findings, conclusions derived from the analysis and the recommendations that can help to improve the irrigated wheat production in Gelan Guda sub-city. The next subsection presents summary of findings, concluding statements, recommendations and then Recommendations for further studies**.**

5.2 summary of finding

The study identifies several key challenges in irrigated wheat production in the district. The top five issues are floods (16.51%), disease and pest problems (14.68%), limited access to quality seeds, fertilizers, and agrochemicals (12.84%), low productivity (11.93%), and bird attacks on wheat (11.01%). Additional challenges include inadequate knowledge and skills in irrigation management (9.17%), untimely excess rainfall (7.4%), low quality of wheat products (6.47%), poor performance of small-scale irrigation schemes (5.5%), and lack of financial support (4.59%). These factors collectively hinder the productivity and efficiency of irrigated wheat farming in the area, highlighting the need for improved agricultural practices, better input supply systems, enhanced farmer education, and stronger financial support mechanisms.

The descriptive statistics result highlights significant opportunities for irrigated wheat production in the Gelan Guda district. The primary opportunity is the availability of irrigable land, with 27.52% of the land identified as suitable for irrigation. This ample irrigable land provides a solid foundation for expanding wheat production. Additionally, there is a high level of commitment from the government, ranked second at 25.69%. This governmental support can drive policy initiatives, funding, and infrastructure development crucial for enhancing irrigation practices. The demand for wheat, noted by 24.77% of respondents, underscores the market potential and economic incentives for increasing production. Finally, the availability of water resources (22.02%) remains a critical factor enabling effective irrigation and supporting the sustainability of wheat farming in the district.

5.3 Conclusions

This study was conduct to identify the challenges and opportunities of irrigated wheat production project in Gelan Guda sub city, Oromia regional state Ethiopia. For this study primary data was collected from 109 randomly selected irrigated wheat producers in the district. Based on descriptive results this study concluded that the majority of irrigated wheat producers were motivationally active, male headed farmers and more educated. Crop, vegetable and livestock production was the main livelihood sources in the district. Both farmers' field visit days and extension meetings are the major extension services in which majority of irrigated wheat producers were participated. Yield gained from irrigated wheat for majority of producers was poor. An improved technology user in the district was very low. There is high yield variation between maximum and the minimum production because of unexpected floods during harvest time and other challenges.

Based on the findings of this study, it is evident that flood poses a significant obstacle, accounting for 16.51% of the challenges encountered in irrigated wheat production. Following closely behind flood concerns, wheat disease and pest problems represent another substantial challenge, constituting 14.68% of the hurdles faced by farmers. Moreover, input supply such as limited access to quality seeds, fertilizers, and agrochemicals emerges as the third major challenge, making up 12.84% of the hindrances in irrigated wheat production.

Conversely, the study identifies several opportunities that can bolster irrigated wheat production in the district. The presence of irrigable land, comprising 27.52% of the opportunities, offers a solid foundation for expansion and intensification of wheat cultivation. Furthermore, the high commitment from the government, accounting for 25.69% of the opportunities, signifies strong policy support and institutional backing for agricultural development. Additionally, the robust demand for wheat, representing 24.77% of the opportunities, presents a promising market outlook for farmers. Land use planning is essential from the local government bodies for its implementation and the quality has to get an attention from the producer side.

5.4 Recommendations

Based on the finding of this study the following recommendations were forwarded for concerned bodies in the district:

- First, the government (Gelan guda agricultural office) should discuss with small holder farmers to use the land which is located nearer to the river use for vegetable production to minimize flood damage.
- Second, the government should develop or strengthen agricultural insurance scheme and financial assistance programs to help farmers recover from flood related loses. In addition, the government should uses comprehensive strategies to mitigate impact of flood by strengthening the implementation of soil conservation measures, the use of weather forecasting, and remote sensing technologies.
- Third, the agricultural office should provide wheat varieties that can resistance and tolerant to common wheat diseases and pests by collaborating with agricultural research centers. The government should allow farmers to rotate wheat with vegetables or non-wheat crops. Special attentions should be given for challenges related to input supply such as quality seeds, fertilizer, and agrochemicals. The farmers should follow up and provide real information about the health of wheat crops.
- Fourth, the concerned bodies should provide trainings, and workshops related to irrigated wheat production in addition to farmers' field visit days and extension meetings.
- Fifth, the government should strengthen the links between irrigated wheat producers and consumers to minimize unprofitability by controlling illegal traders.

5.5 Recommendations for further studies

- ✓ Further researches are needed to examine the impact of irrigated wheat production on farmers' livelihood, determinants of irrigated wheat production participation, and determinants of improved wheat technology packages in the study area.

REFERENCES

Abera, W., L. Tamene, K. Tesfaye, D. Jiménez and H. Dorado *et al*., 2022. A data-mining approach for developing site-specific fertilizer response functions across the wheat-growing environments in Ethiopia. Exp. Agric., Vol. 58.

Anteneh A, Asrat D. Wheat production and marketing in Ethiopia: Review study. Cog Food Agric. 2020;6(1):1778893.

Asrat, D., A. Anteneh, M. Adem and Z. Berhanie, 2022. Impact of Awash irrigation on the welfare of smallholder farmers in Eastern Ethiopia. Cogent Econ. Finance, Vol. 10.

Awlachew SB, Yilma AD, Loulseged M, Loiskandl W, Ayana M, Alamirew T. 2022. Water Resources and Irrigation Development in Ethiopia. Available from: https://www.researchgate.net/profile/Mekonen-Ayana/publication/42765483_Water_Resources_and_Irrigation_Development_in_Ethiopia/links/558be39e08ae591c19d8d740/Water-Resources

Badebo A, Bekele E, Bekele B, Hundie B, Degefu M, Tekalign A, et al. Review of two decades of research on diseases of small cereal crops in Ethiopia. Increasing crop production through improved plant protection—Proceedings of the 14th Annual conference of the Plant Protection Society of Ethiopia (PPSE); 2008, December 19–12; Addis Ababa, Ethiopia.

Badebo A, Hundie B. Incidence and challenges of rusts in wheat production. In: Bishaw Z, Alemu D, Atilaw A, Kirub A, editors. Containing the Menace of Wheat Rusts. Addis Ababa (Ethiopia): Ethiopian Institute of Agricultural Research; 2016. p. 41-52.

Bentley, A.R., J. Donovan, K. Sonder, F. Baudron and J.M. Lewis *et al*., 2022. Near-to long-term measures to stabilize global wheat supplies and food security. Nat. Food, 3: 483-486.

Braun HJ, Atlin G, Payne T. Multi-location testing as a tool to identify plant response to global climate change. In: Reynolds MP, éditor. Climate change and crop production. Wallingford (UK): CABI; 2010. p. 115-38

CSA, 2020. AGRICULTURAL Sample Survey 2020/21(2013 E.C.) (September – December, 2020). Report On Farm Management Practices (Private Peasant Holdings, Meher Season) THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA CENTRAL STATISTICAL AGENCY: Addis Ababa (2020), P. 534

Dencic S, DePauw R, Kobiljski B, Momcilovic V. Hagberg Falling Number and Rheological Properties of Wheat Cultivars in Wet and Dry Preharvest Periods. Plant Prod Sci. 2013;16(4):342-51.

EIAR,.2022 Irrigation-based Wheat Production: A transformation from Import to Export. Available from: http://www.eiar.gov.et. Accessed 2022 May 10.

Endalew, B., M. Aynalem, F. Assefa and Z. Ayalew, 2020. Determinants of wheat commercialization among smallholder farmers in Debre Elias Woreda, Ethiopia. Adv. Agric., Vol. 2020.

FAO, 2020. Food and Agriculture Organization of the United Nations, Rome. http://faostat.fao.org/default.aspx

FAO. (2020). Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/faostat/en/#data/QC

Gebremedhin GH, Asfaw KK, 2022. Irrigation in Ethiopia: A review. Available from: https://core.ac.uk/download/pdf/234664348.pdf.

Gurmu, Z.A., H. Ritzema, C. de Fraiture and M. Ayana, 2019. Stakeholder roles and perspectives on sedimentation management in small-scale irrigation schemes in Ethiopia. Sustainability, Vol. 11.

IFPRI. (2019). International Food Policy Research Institute. Retrieved from https://www.ifpri.org/publication/ethiopias-wheat-maze

Kifle, T., D.Y. Ayal and M. Mulugeta, 2022. Factors influencing farmers adoption of climate smart agriculture to respond climate variability in Siyadebrina Wayu District, central highland of Ethiopia. Clim. Serv., Vol. 26

Kiss, I. (2011). Significance of wheat production in world economy and position of hungary in it. Abstract: Applied studies in agribusiness and commerce [Thesis]. University of Debrecen.

Krupnik, T.J., U. Schulthess, Zia Uddin Ahmed and A.J. McDonald, 2017. Sustainable crop intensification through surface water irrigation in Bangladesh? A geospatial assessment of landscape-scale production potential. Land Use Policy, 60: 206-222.

Lemi,.C. 2014. The challenge and opportunity of farmers in small scale irrigation practice in case of Dugda district, East Shoa Zone, Oromiya Regional State, Ethiopia.

Menna A, Semoka J, Amuri N, Mamo T. Wheat response to applied nitrogen, sulfur, and phosphorous in three representative areas of the central highlands of Ethiopia. Int J Plant Soil Sci. 2015;8(5):1–11

Mosissa F. Progress of Soil Acidity Management Research in Ethiopia. Available from: https://assetpdf.scinapse.io/prod/2810281594/2810281594.pdf. Accessed 2022 Jul 13

Muluneh, A., T. Tadesse and R. Girma, 2022. Assessing potential land suitable for surface irrigation using GIS and AHP techniques in the Rift Valley Lakes Basin, Ethiopia. Sustainable Water Resour. Manage., Vol. 8.
Alemu, Y. and D. Tolossa, 2022. Livelihood impacts of large-scale agricultural investments using empirical evidence from Shashamane rural district of Oromia Region, Ethiopia. Sustainability, Vol. 14.

Noort, M.W. J., S. Renzetti, V. Linderhof, G.E. du Rand, N.J.M.M. Marx-Pienaar, H.L. de Kock, N. Magano and J.R.N. Taylor, 2022. Towards sustainable shifts to healthy diets and food security in Sub-Saharan Africa with climate-resilient crops in bread-type products: A food system analysis. Foods, Vol. 11.

Ozkan, B., A.K. Dube and M.R. Reed, 2022. Role of Agricultural Extension in Building Climate Resilience of Food Security in Ethiopia. In: Food Security and Climate-Smart Food Systems Building Resilience for the Global South, Behnassi, M., M.B. Baig, M.T. Sraïri, A.A. Alsheikh and A.W.A.A. Risheh (Eds.), Springer International Publishing, Cham, Switzerland, ISBN: 978-3-030-92737-0, pp: 219-239.

References

Regasa, M.S., M. Nones and D. Adeba, 2021. A review on land use and land cover change in Ethiopian Basins. Land, Vol. 10.

Sharma RC, Crossa J, Velu G, Huerta-Espino J, Vargas M, Payne TS, et al. Genetic Gains for Grain Yield in CIMMYT Spring Bread Wheat across International Environments. Crop Sci. 2012;52(4):1522-33.

Shiferaw B, Smale M, Braun HJ, Duveiller E, Reynolds M, Muricho G. Crops that feed the world 10. Past successes and future challenges to the role played by wheat in global food security. Food Sec. 2013;5(3):291-317.

Shikur, Z.H., 2020. Agricultural policies, agricultural production and rural households' welfare in Ethiopia. J. Econ. Struct., Vol. 9.

Shikur, Z.H., 2022. Wheat policy, wheat yield and production in Ethiopia. Cogent Econ. Finance, Vol. 10.

Solh M, Nazari K, Tadesse W, Wellings C. The growing threat of stripe rust worldwide. Available from: https://globalrust.org/sites/default/files/posters/solh_2012.pdf. Accessed 2022 Jul 13.

Tadesse W, Bishaw Z, Assefa S.., 2019. Wheat production and breeding in SubSaharan Africa: Challenges and opportunities in the face of climate change. Int J Clim Chang Strateg Manag. 11(5):696-715.

Tadesse W, Morgounov AI, Braun HJ, Akin B, Keser M, Kaya Y, et al. Breeding progress for yield in winter wheat genotypes targeted to irrigated environments of the CWANA region. Euphytica. 2013;194(2):177-85.

Tadesse, W., H. Zegeye, T. Debele, D. Kassa and W. Shiferaw *et al*., 2022. Wheat production and breeding in Ethiopia: Retrospect and prospects. Crop Breed. Genet. Genomics, Vol. 4.

Tadesse, W., Z. Bishaw and S. Assefa, 2019. Wheat production and breeding in Sub-Saharan Africa: Challenges and opportunities in the face of climate change. Int. J. Clim. Change Strategies Manage., 11: 696-715.

Zegeye, M.B., A.H. Fikrie and A.B. Asefa, 2022. Impact of agricultural technology adoption on wheat productivity: Evidence from North Shewa Zone, Amhara Region, Ethiopia. Cogent Econ. Finance, Vol. 10.

APPENDIX

ቅድስት ማርያም ዩኒቨርስቲ
St. Mary's University, Ethiopia

Dear Respected Respondents:

This questionnaire is conducted to collect data for a research on: **CHALLENGES AND OPPORTUNITIES OF IRRIGATED WHEAT PRODUCTION; THE CASE OF GELAN GUDA SUB CITY**. An independent study by Digafe Mekonnen for thesis submitted to the departments of arts of project management for partial fulfillment of the requirements for the degree of Master Project Management at **St Mary's** University, Addis Ababa, Ethiopia. I would like to assure you that your genuine responses will be used only for research purpose and kept confidential and anonymous.

Thank you for your cooperation!!!

Kind Regards
Digafe Mekonnen
Email:dgafemekennen9@gmail.com

Phone; 922454116

Instruction: Dear respondents, you do not need to write your name. Please put **(√)** mark in Response box/column for closed ended questions.

.

1: Demographic characteristics of the respondents

1. Sex:

1. Male [ ] 2. Female [ ]

2. Age:

1. Below 30 [ ] 2.31-40 [ ] 3. 41-50 [ ] 4. Above 50 [ ]

3. Educational Level

1. Primary school (1-8 grades) [ ] 2.Secondary school (9-10 grades)[ ]

3. Technical and vocational training [ ] 4.High school (11-12 grades) [ ]

5. First Degree [ ] 6.Master's degree and above [ ]

4. Marital status; 1.Married [ ] 2.Single [ ] 3.Divorced [ ] 4.Widowed [ ]

2: Information on the wheat farm Location

1, Region--- ----------
2, Zone-- ----------
3, wereda Administration- ----------
4, Specific Area /village-- ----------

3: Hosting farmers information

A, Total land holding:

i. Irrigated----------
ii. non-irrigated—----------
iii. Rented----------
Iv. Owned----------

4: Livelihood Source

Indicate the main sources of your family livelihood from the list given below.		Response	
		1. Yes	2. No
1	Crop production &vegetable farm		
2	Livestock production		
3	Crop, vegetable &livestock		

If others specify here----------

5: Do you participate in any agricultural extension service/event so far?

Exn,event ;-	Response	
	1. Yes	2. No
1.Training		
2.Workshop		
3.Farmer Field visit day		
4.Extension Meeting		

6, Total yield obtained from your demonstration farm ----------ku\ ha
7, How do you perceive yield obtained? (1)Very Good, 2. Good, 3. Poor
8, Do you use improved crop technology so far? (1.) Yes 2. No

Others----------

9. How the agricultural office helps when farmers lose their irrigation because of flood,birrde attack and other reasons?

……
……

10. In what depth the agricultural office work on increasing profitability like on technology, skilled man power, land selection and inputs (seed,fertilizer,chemicals etc.)
_____
_____
_____.

11. Challenges of irrigated wheat production in the study area

Sr.no	Challenges	Rank
1	Wheat attacking birds	
2	No productivity or profitability	
3	Floods	
4	Input supply such as Limited access to quality seeds, fertilizer, and agrochemicals	
5	Inadequate farmers knowledge and skill in irrigation management	
6	In adequate and low performance of small scale irrigation schemes	
7	Disease and pest problem	
8	Lack of financial support for irrigated wheat	
9	Low quality of wheat products.	
10	Untimely excess rainfall	

If others specify here----------

12. Opportunities of irrigated wheat production in the study area

Sr.no	Opportunities	Rank
1	Availability of water resource	
2	Demand for wheat	
3	Irrigable land	
4	High level commitments from government	

If others specify here----------