Fikadu Nemera Integrated Agricultural Farm Development (Amended Feasibility Study with Project Financing)

Project location: Benishangul Regional State, Assosa Zone, Homosha Woreda, Tsore Alimtma Kebele

Project Owner: - Ato Fikadu Nemre Waqo

Project Capital: - 240,373,009 Birr, Equity Contribution: - 25% (60,093,502 Birr) and Bank Loan:- 75% (180,280,507 Birr)

By:-Soddu Development consultancy Private Enterprise, Mobile +251913434303

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Assosa

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Prerequisite

The data and information on this report includes certain statement, estimates, projections and forecasts that are produced based on the information provided by the concerned persons, Owners of the Project and reasonable assumptions made and on the information particularly obtained from **DATUM Engineering WWC Consultancy** and **EA Engineering and Artistic consulting PLC** study consulted organization. Hence, the information and analysis presented in this report is not and does not imply to be comprehensive or to have been independently verified. Although due care and thoroughness has been taken to prepare this report, still it may contain certain error or non-accuracy of the information at the source and hence the actual results may differ from the presented information. Thus, the potential user of this report is encouraged to carryout additional diligence and gathers any information he/she feels necessary about the project promoter and his project for making an information decision.

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EXCUTIVE SUMMERY

Project Title: - "Fikadu **N**emera Integrated Agricultural Farm".

Project Owner: Ato Fikadu **N**emera

Development site location of the project:-Benishangul Regional State, Assosa Zone, Homosha Woreda, specifically at Tsor Alimtma Kebele.

Project Descriptions: - the promoter has decided to make irrigation based investment on a total of 250 ha out of which 45 (Banana with 8.5 ha, Avocado on 6 ha, Orange of both red & Valencia types on 5 ha, papaya on 2.5 ha, lemon on 3 ha while onion on 10 ha and tomato on 10 ha land) hectares land has so far developed with fruit and vegetables while 10 hectares land has been developed with construction and building while the remaining 195 ha land hasn't been developed. The existing developed land of vegetables and fruit planted is 20 ha and 25 ha respectively while the land on which construction has taken place is 10 ha. Accordingly, the project promoter has proposed to expand his project to six types of fruits that consists of Banana on 41.5 ha, Lemon on 7 ha, Orange (both Red and Valencia) on 35 ha, Papaya on 12.5 ha, Avocado on 34 ha and Mango on 30 ha in which the total land of fruit becomes 165 ha while the two type vegetables that consists of Onion, and Tomato will be developed on the total land of 20 ha (on 10 ha for each vegetable types) and the remaining 15 ha land will be used for construction and buildings starting from the first year of planting with providing more attention on fruit production. The proposed fruits and vegetable crops are of high valued products which fetch high national and foreign currency for the country.

Project Beneficiaries: - the integrated farm that consists of the irrigation based fruit and vegetable project will benefit 22 permanent employees and more than 1210 man day of works for casual workers per year. In addition the country as a whole will be benefited from the integrated farm project as it is expected to generate substantial national and foreign currencies through producing exportable vegetable and fruits at high quality in addition to train those local people both in the form of providing employment opportunities and practicing modern agricultural irrigation technology supplies.

Project Cost: - the total integrated farm cost is estimated to be Birr **240,374,009** consisting of Birr **102,603,025** as irrigation project fixed cost (Irrigation construction cost, Machinery and

equipment cost, vehicle cost, and office furniture cost), Birr **2,950,000** as land development cost, and Birr **134,820,984** as operating costs.

Source of Fund: - the above irrigation farm cost indicated is supposed to be financed in the ratio of 25:75 by the project promoter and by the Bank in which Birr **60,093,502** and Birr **180,280,507** will be financed by the project promoter and the Bank respectively.

For the source of the equity to be contributed, the promoter has developed 45 ha of land with the production of 25 ha land with fruit and 20 ha land with vegetables in which the equity asset will be considered with the cost of land development cost (in which currently 120 ha land has been cleared) of birr 1,416,000 as well as construction that includes Water Supply & Installation cost (Including bore hole/ drill Water and reservoir construction cost) and a total of 12 pond water collection reservoir by cost of birr 27,853,261, construction cost that includes project owner residence room and site road construction with the total cost of birr 22,819,942.05. In addition to this constructions, the owner also purchased machineries that includes Solar Powered Water Supply with its installation cost of birr 3,701,325 and one tractor with cost of birr 2,175,000 and vehicle of single pick up with cost of birr 2,700,000.

Moreover, the equity asset that has been invested on the developed land of fruit of 25 ha yields the existing Asset Valuation cost of fruit of 9,375 plants with a cost of 1200 birr each fruit that costs a total cost of birr 11,250,000.

Accordingly, the total equity assets that has been invested on the land that has so far developed has been calculated with the total cost of birr **70,499,528.5** in which the owner will requested the bank to granted as an equity asset that has also been verified by the professionals hired as consultancy from **DATUM Engineering WWC Consultancy**, **EA Engineering and Artistic consulting PLC** as well as **Soddu Development Private consultancy that conducted feasibility study** in which they analyzed that the equity asset at hand indicated that it is more enough compared to the 25% owner's equity cost to be contributed which is of birr **60,093,502** expected to contribute to the bank.

Statement of Feasibility: - The income statement of this irrigation project exhibited a net profit that will be obtained starting from the third year of production ranging between Birr **63,153,459**

during the third year and Birr **2,329,981,937** during the tenth year of the project thereby generating average profit of Birr **856,676,240** over the first ten years. Similarly, the cash flow analysis also reveals positive net cash inflow starting from the third year as the products are mainly fruits as it starts production at the third year production in which its cash inflow of Birr **167,912,667** will be obtained at the third year and Birr **2,496,072,223** will be obtained during the tenth year of the project thereby generating average net cash inflows of Birr **888,002,240**. The Net Present Value (NPV) at 8.5% discount rate starting from the grace year of the third year is found to be Birr 291,624,818 which shows that the proposed new investment add value to the existing firm by Birr 291,624,818. Moreover, both the Benefit Cost Ratio (BCR) and the Net Benefit Cost Ratio (NBCR) are found to be 1.97 and 0.97 respectively which shows that each birr proposed to be invested in this business will contribute Birr 0.66 after covering all the necessary operating costs and covering cost of capital for money on loan as well as risk assumed. More importantly, the Internal Rate of Return (IRR) are found to be enormously high (67.5 percent), which is to indicate that the incremental cash inflows from the proposed new investment can finance cost of capital as high as 67.5 percent, while the current increase at which the loan is supposed to be secured from DBE is not more than just 11 percent. The financial projection calculated above shows that the project is financially viable and liquid enough to smoothly finance the planned operations.

1. Introduction

Ethiopia is one of the vast countries in Africa with a total land area of 1.13 million Km^2 and over 80 million population size. The country is predominantly agrarian in which agricultural production is a source of livelihood for over 80% of its population.

The agricultural practice of the country is characterized by rain fed subsistence farming that use outdated farming system which leads to low level of productivity and frequent drought and food insecurity problem in most parts of the country. To improve the productivity of the sector and upgrade the means of production the involvement of private sectors is believed to play a vital role on irrigation farm but due to the lack of awareness most of the domestic investors were not interested to inter to the sector in the past years. Understanding this fact the government has introduced varies incentive packages to attract investors to the sector.

Fikadu Nemera integrated farm is one of the very few investment companies that engaged in the agricultural sector and currently the company acquired 250 ha of land in Benishangul-Gumuz region, Assosa woreda, Tsore Alimetema kebele to undertake agricultural development out of which 45 hectare land is already developed for irrigated crop production (especially vegetable and fruits) production. To this end to expand the integrated farm project to its maximum capacity of production starting from the third year of production year hired three consultancies to assess the water resource potential of the project area, prepare a detail planning and construction design of the irrigation system as well as conduct the feasibility study in which the two reports are submitted in addition to this commercial feasibility study report for verification.

The agricultural sector has always been an important component of the Ethiopian economy. Moreover, the Ethiopian federal democratic republic government adopts an economic policy that encourages and attracts domestic as well as foreign and social sectors which moreover play their significant role in fostering economic and social development of the country. Especially, the market oriented economic policy of the country is believed to create conductive investment opportunity for the private sector. Taking these opportunities in mind, many domestic and foreign investors had engaged in various economic and social sectors and contributed their part in the overall development of the country.

Though, the smallholder irrigation farms in Ethiopia may not be able to produce the required quantities with acceptable quality following the growing demands of agricultural outputs as the result of both raw materials in the emerging manufacturing industries and food items for the growing population is in need. This justifies the need for policy focus on encouraging the private investors in the large commercial farms focusing on irrigation mechanism so as to achieve the long run development targets of the country. This agricultural development enterprise owned by Ato **Fikadu N**emera also decided to engage in large scale irrigation investment which aims at production of fruits and vegetables in a focus of fruits consisting of Banana, Valencia orange, red orange, Mango, papaya, avocado as well as Lemon and vegetable consisting of onion and tomato at large for exportable market on one hand and for domestic market on the other hand. It is against this background that this commercial irrigation farm feasibility study is being prepared and presented for the Bank.

This commercial feasibility study is the integrated irrigation farm project that consist many sections. Brief historical background of the project is presented in section 2. The next section 3 establishes the link between the irrigation project and the overall national socio-economic strategies and policies. Section 4 describes the project location, features and economic base of the people surrounding the irrigation project. Detailed irrigation project objective is presented in section 5 which is followed by section 6 which deals with the potential market and demand analysis of the project. Organization and management of the integrated irrigation and animal farm project is described in section 7. Detailed financial analysis of the project is presented in section 8, which is followed by section 9 which deals with project environment impact assessment as well as Risks with their mitigation measures are narrated while section 10 provides the SWOT Analysis of the Irrigation of Vegetables and Fruit Production section 11 summarizes the report as conclusion and recommendation. Moreover, the potential water resource and its Planning and the design constructions of the irrigation system with their BOK are prepared and presented for the bank with this report.

2. Brief History of the Project Promoter

2.1. Business Overview

Fikadu Nemera Integrated Farm Development is a sole proprietorship enterprise which is an integrated farm project aimed to produce vegetables and fruit that includes vegetables of two types; tomato and onion as well as fruit that includes six types of Banana, Lemon, Red Orange, Valencia Orange, Papaya, Avocado, and Mango on the total land areas of 250 ha. The project is established with educated middle level domestic investor who has long term business experience in profitable business for many years at investment licence number of 4996/2023 and date of 27/12/2023 as well as trade with reference number of BN/8/1/001359/2016 and date of October 30/2016 E.C that owned a total land of 250 ha. Accordingly, he has planned to expand the already farmed 65 ha land developed with the production of Vegetables and Fruits mentioned above by expanding the land to 85 ha at the first year, and will increase each year's until the tenth year of production.

As the Promoter will legally pass the current integrated farm development from Benishangul Gumuz regional state Industry and Investment Bureau and started production of Vegetables and planting around nine types of fruits on 45 hectare land, he has planned to expand the production capacity and produce a total of 11,025 Quintals of Vegetables, 64750,quintals of fruits farm products per year at the end of the third ear after the acquisition of the investment working capital as well as purchasing new machineries planned to be purchased.

2.2. Sales and Revenue History

Ato Fikadu Nemera, the owner of the integrated farm has an experience in business like Gold Mining, Construction materials production, quarry stone production, and general trading in which he has made the profit and able to bring the equity contribution expected of him today. Regarding the sales revenue over the past few years, he has shown annual sales of 20,000,000 ETB in 2015 E.C, 36,546,000 ETB in 2016 E.C as well as with Gross profit margin which is analyzed between gross sales revenue and the direct costs of sale is 25%, the operating profit margin of the project from the income statement and focuses on indirect costs is 10.5% while the Net profit margin from income statement analysis is 7.9% from the revenue stream of Gold mining, Granite and quarry

stone production that shows us the previous project was effective. In addition to this, he has rental house that he will collect a net profit of 1,200,000 annually. Accordingly, the source of income for this new project will be the profit as well as the sales from the mentioned gold mining project in which he can collect up to 42KG per year as well as the granite and quarry stone production that all together supports him in this business.

2.3. Credit History

Regard to Bank relation and status, Fikadu Nemera has developed status in working with many banks that includes Awash Bank, Abay Bank as well as Regional Microfinance in which he has granted loan and repaid with the schedule time and has no loan non-payment history from any financial institutions.

In order to bring up to date this investment, the Promoter has now decided to make considerable investment in the forms project finance policy of obtaining working capital and purchasing of new machinery that consists two tractors with accessories and vehicles that includes one ISUZU FSR Tracker, one Tracker with Van/Refrigerator and one Pick up as well as construction of buildings. Such Integrated agricultural development system will require large investment which the owners find it difficult to finance at this time and needs a loan with total financial project cost of 240,374,009 ETB from which working capital will be 134,820,984 ETB and fixed cost will be 102,603,025 ETB as well as land development cost will be 2,950,000 ETB. Therefore, the promoter now demand long term loan with the project financing system from the development Bank of Ethiopia, the Bank which is ever supportive and reliable coalition of irrigation agricultural development investment in Ethiopia that the loan will be paid with seven years with standing loan of ETB 180,280,507 birr and paid with equal installation 18,028,051 birr each year.

2.4. Operational History

Ato Fikadu Nemera Wako, has BA degree in Business Management and works for more than 35 years with Government (Higher Official), UNHCR HR head and NGOs with higher position and has developed management administration skill and experience that he is capable of managing such huge company. Moreover, with his qualification and exposure with many governmental and

nongovernmental organizations, he has capability of making and managing business that he is engaged with.

To achieve its establishment objective, Fikadu Nemera Integrated Farm development enterprise has hired the Project coordinator who has BSc degree in Horticulture who more than 12 years' experience in similar irrigation field and has the capacity of coordinating the project while Ato Fikadu Nemera himself will be working as the General Manager. In addition to this, the project will hire about 22 permanent working staffs as well as more than 1210 day laborer workers working for 8 hours in shift and will provided the necessary training starting from general Manager up to the supportive staff to achieve the objective of the enterprise.

On the case of road accesses to the developed land areas, the project owner has constructed the road accesses starting from main asphalt road that passes from Assosa city to Homosha woreda to the project area with a total distance of 1km as well as on the boundaries of the project site and inside the project that road facilities has constructed with the distance of 2.5Km and constructed cost of 17,502,962.48 birr in which the BOK and design is presented in the 'Existing Document files' as well as the cost is considered as equity asset on the construction cost of Table 6 below of irrigation and construction cost part of the project

The road constructed from the main road of asphalt that pass from the main town, Assosa to Homosha Woreda, and connect to the site project in which the road type is all-weathered type of road that help to transport the produced vegetables and fruit to the destination places and ease the accessibility case.

2.5. Market Position

It is clear that vegetables and fruit products has the major agricultural components as the product is mainly used as consumption in household, Restaurants and Food Services in which the Local restaurants, cafes, and catering companies looking for fresh, high-quality ingredients, Retailers in which the Local grocery stores and supermarkets that aim to offer fresher, locally sourced produce, Agro-Processing Companies in which Companies involved in processing fruits and vegetables to produce jams, sauces, or dried fruits also compete in the market will need the products.

Accordingly, it is recommended that if the promoter now obtained the long term loan with the project financing system from the development Bank of Ethiopia, the Bank which is ever supportive and reliable coalition of irrigation agricultural development investment in Ethiopia, with the mentioned loan of ETB 180,280,507 birr, he can repaid with equal installation 18,028,051 birr each year by taking the grace years of three years as the fruit will provide yields at the time.

3. Background

3.1. Policy Framework

The Government of Ethiopia has identified Agricultural Development Led Industrialization (ADLI) as its core development policy and map to industrialization. Although the government's priority attention is still on increasing the productivity and production by the smallholder farmers, recognizing the high prevalence of rural poverty and large productivity gap, due recognition is now given to the private commercial firms in the agricultural sector especially to invest on agricultural irrigation projects than depending on rain fed system. This is reflected in the Policy and Investment Framework (PIF) objective of the country which states *"to contribute to Ethiopia's achievement of middle income status by 2020"*. The Development Objective aims to "Sustainably increase rural incomes and national food security, which represent the concepts of producing more, selling more, developing the environment, eliminating hunger and protecting the vulnerable against shock and disasters.

Ethiopia has been taking significant steps to develop its agriculture sector, particularly concerning fruits and vegetables. The government's policy frameworks and strategies aim to improve production, promote export, and enhance food security. Here are some of the key policies and strategies related to fruits and vegetables in Ethiopia:

Growth and Transformation Plan (GTP): GTP I (2010-2015) and GTP II (2015-2020) emphasized agricultural growth, including fruits and vegetables, by promoting commercial farming, improving irrigation systems, and providing support to smallholder farmers. The plans aim to increase productivity and enhance value chains for horticultural products, including investment in processing and export.

Ethiopia's Horticulture Development Strategy: Focused on increasing the production of fruits and vegetables for domestic consumption and export that Encourages the establishment of commercial farms, improving irrigation, and adopting modern farming technologies.

National Agricultural Research System: Emphasizes research and development (R&D) in horticulture to develop disease-resistant and high-yield crop varieties. Also encourages partnerships with academic institutions and international research organizations.

Irrigation Development: Investment in irrigation is crucial for increasing productivity. The government has been working to expand irrigation coverage, particularly in regions suitable for fruit and vegetable cultivation.

Market Access: Improving market access for farmers through infrastructure investments, including roads and transportation networks. The government is also working on establishing more efficient supply chains and market information systems.

Export Promotion: Policies are in place to support the export of high-value horticultural products. This includes offering incentives for farmers and exporters engaged in producing fruits and vegetables destined for international markets.

Nutrition Programs: Initiatives aimed at promoting the consumption of fruits and vegetables to improve dietary diversity and nutrition among the population.

Ethiopia's focus on fruits and vegetables is evident in its agricultural policies and strategies aimed at enhancing production, improving food security, and increasing exports. Continued investment in infrastructure, capacity building for farmers, and adaptive research will be crucial to overcoming challenges and achieving the desired outcomes in this sector. The government's ongoing efforts, in collaboration with private sector stakeholders and international partners, are vital for the sustainable development of Ethiopia's horticulture industry.

3.2. Irrigation Potential in Ethiopia

Irrigation potential can be defined as the total land area which is technically feasible, economically profitable, socially viable, and environmentally acceptable that is irrigated or capable of being irrigated based on water and land availability. The estimation of the irrigation potential of a region may vary a lot from study to study or from time to time. Country or regional studies estimate irrigation potential based on a variety of criteria. For instance, some take into account land resources only, others consider water availability, and the rest may take into consideration the environmental and economic conditions of the country, etc. Considered factors like production geography, the potential performance of irrigated agriculture, potential runoff, irrigable area, associated water delivery costs, etc., in their assessment of the potential for irrigation investment. Recently, models, remote sensing, and GIS technologies are becoming researchers' favorites in

determining the irrigation potential of a region used model to assess and map the irrigation potential of the Abbay (Nile) river basin in Ethiopia. On the other hand, remote sensing and GIS have been used to assess the irrigation potential of a Canal system in India. Such deviations in assessment and estimation strategies lead to ambiguous and inconsistent reports on the irrigation potential of countries; the same is true for Ethiopia.

Most of the classic irrigation related survey studies in Ethiopia came from the work of the iconic Engineer Seleshi Bekele Awulachew (well known for his role as the Minister of Water Irrigation and Energy of Ethiopia (WIEE) and chief negotiator in the trilateral negotiations in regards to the Grand Ethiopian Renaissance Dam (GERD)) and his colleagues during his days at IWMI. According to, about 5,300,000 hectares of land in Ethiopia can be potentially irrigated. This has shown an advance of about 28.3% over the estimation by, in which they reported the country's irrigable land to be 3,798,782 ha. The variation arises from the fact that included harvested rainwater and groundwater, which has the potential of irrigating an additional 1,600,000 ha of land. On the other hand, in 2016, FAO estimated the irrigation potential of Ethiopia at about 2.7 million ha, based on the availability of water and land resources, technology, and finance, and even outlined the hectare and percentage contribution of each drain- age and river basin. This is a typical manifestation of variation in the estimation of a country's irrigation potential, even by a similar author, based on things taken into consideration during reporting or survey.

According to the Agricultural Transformation Agency (ATA), the current total ground- water resource of Ethiopia is estimated to be 27.27 billion m3, which has a 76.2% in- crease compared to the highest estimation, 6.5 billion m3. This variation in the estimation of groundwater resources makes sense as the total groundwater resources mapping area has increased from time to time and currently sits at 234,772 km2. ATA in its latest 2020/21 annual report, also revealed that the country has an irrigation potential of 3,088,395 ha which can support 6,176,898 farm households. However, one can realize that the irrigation potential of Ethiopia estimated by a decade or more ago is superior by 23% and 71.6% respectively, to the current estimation by ATA. This gets difficult to accept, especially when realizing the currently estimated ground- water resource of the country by ATA has increased dramatically (quadrupled) com- pared to the 2.6–6.5 billion m3 estimation in earlier years. Well, again, this discrepancy maybe is related to the differences in the assessment strategies and criteria considered during the evaluations. With all this in mind, for the

sake of this paper, we will make our arguments and discussion based on the latest report on the country's irrigation potential by ATA (3,088,395 ha).

3.3. Total Land under Irrigation

Although Ethiopia has the largest irrigation potential in East Africa, followed by Tanzania and Kenya, it uses only a small portion of it. In its latest annual report, CSA estimated the total irrigated land for 2020/21 by private peasants to be only 181,395 ha, practiced by around 1.4 million households. Sadly, this is only 5.9% and 22.7% of the total land area and the number of farmers respectively, the country's irrigation potential can support.

However, most authors report the percentage of irrigated land to irrigation potential of the country based only on land area irrigated by private peasant holdings, without considering those by commercial farms and sugar estates. This is because though the CSA releases survey reports on different aspects of the private commercial farms, it does not include the areas irrigated by those farms. Hence, it is difficult to obtain data on trends in irrigated land area by commercial farms. However, by considering at least the recent report on the area irrigated by the sugar estates of the country, we might get some more insights into the percentage of the irrigation potential used. According to the Ethiopian Sugar Corporation (ESC), currently, there are eight sugar estates involved in irrigated sugarcane production on an area of 145,030 ha. So, if we sum up the total irrigated land by private peasant holdings and the sugar estates, the total estimated irrigated land area would be 306,425 ha, and this again makes up only 10% of the country's irrigation potential. His Excellency, Dr. Abiy Ahmed, Prime Minister of Ethiopia, in his welcoming speech at the opening of the 35th ordinary session of the African Union (AU) on the 5th February 2022, said:"… Nationally, we have attained production of 20 million quintals of irrigated wheat farmed over 500,000 hectares. This has generated nearly 60 billion birrs in income to our farmers".

One of the main points to take hold of this speech is the claim by the Prime Minister that nationally a total of 500,000 ha of land is under irrigated wheat production. It seems strange that the Ethiopian central statistics agency (CSA) estimated only 181,395 hectares of irrigated crops in the 2020/21 cropping season. Thus, the Prime Minister's claim may be based on the work done during the ' Meher' season of 2022, which in any case re- quires confirmation when the CSA 2022 report is issued. Regardless, even if the estimate by the CSA on irrigated land by private peasants, the

report on the area irrigated by sugar estates from ESC, and the claim by the prime minister are considered (806,425 ha) as the total area currently under irrigation, it would still be only 26.1% of the irrigation potential of the country. This is a clear indicator of how long the country has left to go in its irrigation development, to put its estimated 5.7 million people out of the misery of hunger and put its estimated 22 million people living below the national poverty line above it first and even export crops then.

3.4. Importance of Irrigation to the Ethiopian Economy

The dependence of Ethiopian agriculture on rainfall, and its variability, hampers the production and productivity of millions of smallholder farmers. Rain-fed agriculture is less efficient both in terms of water use and profitability compared to irrigated agriculture. In developing countries, like Ethiopia, rain fed grain yields average 1.5 to ha-1, compared with 3.1 to ha-1 in irrigated agriculture. This is attributed to the decline in crop productivity resulting from the provision of inappropriate doses of water (water deficit and water-logging) from rainfall variability in rain-fed agriculture.

A study found that the average income of farmers practicing rain-fed agriculture in Ethiopia, USD 147 ha-1, is much lower compared to the average income of approximately USD 323 ha-1 generated by farmers practicing smallholder irrigated farming. This shows a 54.5% income difference between the farmers practicing rain-fed agriculture only and the income of smallholder-managed irrigation systems. According to the mean annual income, consumption expenditure, and asset accumulation for irrigators in northern Ethiopia were respectively 97%, 114%, and 103% higher than that of the non- irrigators. Research in the rift valley lake basin, a huge area covering 52,739 km2 and possessing an irrigation potential of 45,700 ha, has also showed farmers deployed in irrigated crop production earn an annual mean income of 10161.5 Ethiopian birr/ETB/ (USD 198) per household, which is 33.6% higher than that of farmers relying merely on rainfall. These figures would have made a visible impact on the national economy in aggregate, as currently 12 million smallholder farming households are involved in agriculture, and they account for 85% of overall employment and an estimated 95% of agricultural production in the country.

Irrigated crop production is also witnessed to create more employment and better pay rate than rain-dependent farming. Revealed mean hours invested in the irrigated farm operation and the associated labor cost are significantly higher than the rain-fed only for all farm activities including,

plowing (71%), weeding (70.8%), harvesting (67.6%) and trashing (65.86%). The labor cost per hectare for irrigated farms is also relatively higher, ETB 535.94(USD 10.5) compared to the rain-fed ETB 305.92 (USD 5.96), and the former creating 42.9% more pay than the latter. This indicates the potential of irrigated crop production in generating more employment and a better pay rate per task com- pared to rain-fed farming. Hence, given agriculture provides the greater chunk of the country's labor, expanding irrigated farming would create sustainable jobs and better income for employees, thus aiding the attainment of the SDG through poverty alleviation.

The degree to which irrigated crop production contributes to alleviating poverty and creating equity tends to differ among the irrigation technology used. A comprehensive study assessing the role of Agricultural Water Management [AWM] technologies in poverty alleviation showed that the poverty incidence among nonusers was 15% higher than the technology users, and the poverty gap and severity were 0.28 and 0.17 respectively for nonusers, whereas it was only 0.19 and 0.11 respectively for users. The study also found that the degree of poverty reduction depends on the AWM technologies used, with 37%, 26%, and 11%, respectively for micro dams, river diversions, and deep wells. This underscores the importance of adopting better irrigation management technologies or methods for better and faster poverty reduction in the country.

3.5. Importance of Irrigation to Food Security in Ethiopia

The 1996 world food summit (WFS) defined food security as a state in which all people, at all times, have physical, and economic access to sufficient, safe, and nutritious food which meets their dietary needs and food preferences for an active and healthy life. This definition lays down four preconditions to be fulfilled for a country or a household to be considered food secure; food availability, access to food, food utilization, and stable supply of food. Fulfillment of these four dimensions is mostly related to agricultural production status and the economic or financial capabilities of households or countries to acquire/import food.

Globally, irrigation has been shown to contribute to all the components of food security. Irrigation was reported to promote food security by increasing crop productivity (food availability), boosting farmer incomes (access to food) encouraging dietary diversity (food utilization), and ensuring year-round crop production (stable food supply). This holds for Ethiopia too, where irrigation was witnessed to contribute to food security by increasing crop production, reducing the risk of crop

failure, and generating higher and year-round farm and nonfarm employment. Moreover, the contribution of irrigation to food security in Ethiopia may take different pathways, some direct and others indirect. Upon studying the role of small-scale irrigation in food security in northern Ethiopia, developed a conceptual framework (Figure 1) to illustrate the many forms through which irrigation contributes to household food security in the country.

3.6. Trends in Irrigation Status during the SDGs

The number of smallholder farmers practicing irrigation and the area under irrigated crop production has not been increasing or decreasing linearly. For instance, the number of irrigators declined by 17% from 2015 to 2016, which then showed a dramatic peak of 52.4% (table 1);

Table 1:- Number of Irrigation VS irrigated areas in Ethiopia

Year	No_ of Irrigators (in 1000s)	Area of Irrigated (in 1000Ha)
2015	1208.5	179
2016	1001.5	158.5
2017	2104.5	195.4
2018	1403.5	181.3
2019	1304.5	211
2020	1428.8	181.3

However, in 2018, a 33.3% decline was registered, followed by another 7% decline in 2020 and an increase of 8.7% in 2021. Overall, the number of smallholder irrigators in- creased by 15.21% in 2021, compared to the number of irrigators back in 2015 at the launch of the SDGs. This 15.21% makes 220,329 farmers, which implies new farmers of this number have started irrigated crop production between the years of 2015 - 2020. Well, with the general assumption of farmers engaged in irrigated crop production would get out of poverty and become food self-sufficient, it can be said that the household incomes and food security of these farmers have been improved due to irrigation. This is not unrealistic, as many studies have emphasized the importance of practicing irrigation farming in generating more income, securing food self-sufficiency, and alleviating poverty.

If the same trend continues, it may also mean irrigated crop production would put only 1% (220,329 farmers) of the 22 million poor people above the poverty line in the remaining years of the SDGs. This is a very small fraction, especially when realizing the country's irrigation potential has the capacity to support an estimated 6,176,898 farming households. In addition, there is no guarantee

that the number of irrigators will not decrease in the coming years, as the number of farmers practicing irrigation fluctuated over the past seven years. Under such a scenario, the contribution of irrigation to poverty and hunger alleviation would even become lesser, thus hampering the success of SDGs.

Similar to the number of irrigators, irrigated hectares of land have also fluctuated over the past seven years. The percentage change in hectares of land irrigated, calculated in comparison to their respective preceding year, is -11.6, 19, -7.8, 14, and -16.4% for the years 2015, 2016, 2017, 2018, 2019 and 2020, respectively. Realizing the government has been working by allocating USD 18 billion of the PIF, expecting a yearly 8% increase in arable irrigated land between 2010 and 2020 this trend is a huge disappointment. Even when the total increase in irrigated land between 2015 (178.904 hectares) and 2020 (181,395 hectares) is considered, there is only a 1.4% increase. Still, this is almost insignificant and is a small impediment to the improvement of the irrigation sector in terms of the amount of capital invested by taxpayers and fund providers.

3.7. Fruits and Vegetable Description and application

Ethiopia is a country with great variety of climate and soil types that can grow diversity of vegetable and fruit crops for home consumption and foreign markets. Currently, the majority of the horticultural crops product comes from the peasant smallholder farms. However, their areas of production and their contribution to the country's total agricultural output were not known much. Based on the survey per capital consumption of the annual fresh production assorted vegetables is about 2.86 million tons. From the total volume of horticultural products 95% is fresh vegetable production. There is no processing of vegetables in the peasant smallholder farm. Production of canned and bottled vegetables is mainly in the Ministry of State Industry (MSI) and Ministry of State Farm (MSF). According to the data from (FAO, 2022) the global fruit production was about 8,685,672 metric tons in 2021 and total avocado harvested area was 858,152 hectares. According to FAO, (2022) avocado production in Ethiopia reached 245,336 metric tons in 2021 and total harvested area was 30585.70 hectares. Ethiopia exported 604.5Qt of avocados in 2021. The main avocado destinations in Ethiopia are the United Kingdom (UK), United Arab Emirates (UAE), Singapore, France, Saudi Arabia and Djibouti. Avocados are second only to bananas in total

production volume in Ethiopia. Bananas, Mangoes, Avocados, Papayas, and Oranges took up 63.30%, 12.49%, 12.39%, 6.16% and 3.52% of the fruit production, respectively.

3.7.1.Banana production system, utilization and constraint in Ethiopia

Ethiopia is known for its diverse agricultural production, and bananas are one of the important crops cultivated in the country. The production and utilization of bananas in Ethiopia can be understood through several key aspects:

Growing Regions: Bananas are grown in all regions of Ethiopia and mostly Southern Nations, Nationalities, and Peoples' Region (SNNPR), Oromia, and some parts of the Amhara region are where banana is produced in large amount. The climate in these areas, characterized by adequate rainfall and favorable temperatures, supports banana cultivation.

Varieties: The most commonly grown type of banana in Ethiopia is the dessert banana (Cavendish bananas). However, there are also varieties used for cooking (cooking bananas or plantains) and other local types.

Farming Practices: Most banana production in Ethiopia is carried out by smallholder farmers. The cultivation practices vary, ranging from traditional methods to some use of improved agricultural practices and technologies. However, challenges such as pests, diseases (like the banana wilt), and lack of access to modern agricultural inputs can affect productivity.

Production Volume: Ethiopia has been increasing its banana production over the years, with efforts aimed at boosting food security and farmers' incomes. While exact figures can fluctuate annually, Ethiopia is among the leading African countries in banana production.

Consumption: Bananas are an essential part of the Ethiopian diet and can be eaten fresh, cooked, or processed. They are an important source of vitamins and nutrients.

Market: The majority of bananas produced are sold in local markets. They are a significant part of the fresh fruit supply in urban areas, and demand often exceeds supply, leading to rising prices, particularly in the dry season.

Exports: There is a growing interest in banana exports, particularly for the Cavendish variety. Ethiopia has begun exporting bananas to Middle Eastern countries and sometimes Europe. This is part of a broader strategy to enhance agricultural exports and increase foreign exchange earnings.

Processing: While the processing of bananas in Ethiopia is limited, there are some initiatives to produce banana-based products like banana chips, flour, and fermented products. These efforts aim to add value to raw banana production and reduce post-harvest losses.

Challenges: The banana sector faces several challenges, including climate change impacts, water scarcity, land degradation, and infrastructure deficits (such as poor roads and market access). Additionally, crop diseases and pest pressures are significant threats.

Opportunities: There are opportunities for growth in the banana sector, including expanding export markets, improving agricultural practices through training and education, enhancing value addition through processing, and leveraging international investments.

Banana production in Ethiopia is not just a critical component of the agricultural sector but also a vital food source for many households. Continued investment in infrastructure, technology, and extension services will be essential to enhance both productivity and utilization in the years to come.

Banana and plantains (*Musa* spp.), generally referred as bananas, are important crops in the world. Bananas are believed to be the earliest plant species to be domesticated (Denham *etal.*, 2003). They are largely grown by smallholders and play major role in food security and income generation for millions of rural poor worldwide. Bananas are the fourth most important food crop in the world after rice, maize and wheat (Molina *et al.*, 2004). The total world production of bananas in 2021 was estimated about 125 million tons, from which 18.4% was produced in Africa (FAOSTAT, 2021).
About 539 thousand tons of bananas were produced on 66.8 thousand hectares of farmland during 2019/20 cropping season in Ethiopia. About 3.5 million smallholder farmers were engaged in producing bananas for home consumption and income generation in the same year. The majority of bananas have been produced in Southern Nations, Nationalities and Peoples (SNNP) and Oromia regions that cover 70.4% and 26.2% of total production in the country, respectively (CSA, 2020).

The current characteristics of banana producers and the major production constraints are not identified. Assessing the type of cultivars available on farmers' hands and identifying farmers' variety selection criteria would also be important to develop sustainable variety development strategy. Except some limited and localized surveys, a wide assessment, addressing the major banana growing areas, has not been undertaken in Ethiopia. Generating reliable information on the points indicated above would have great contribution to develop research and development strategy that help expand good practices and address constraints for banana production in the country. That is why the study was conducted assess the production system, utilization and constraints of bananas in Ethiopia and this paper is aimed to avail information for scientific communities in the country and worldwide.

Table 2:- Areas coverage by Banana with production, yield and consumption in Ethiopia

Year	Area (Ha)	Yield Qt/Ha	Production (Qt)	HH consumption (Qt)	Sale (Qt)	Export (Qt)
2015	53,956.2	89.4	4,782,510.0	2,287,474.5	2,352,516.7	115,600.0
2016	53,688.6	82.0	4,401,344.0	2,009,653.7	2,245,126.0	17,260.0
2017	63,212.9	85.2	5,383,023.0	2,695,817.9	2,520,331.4	18,840.0
2018	59,298.2	83.2	4,936,022.0	2,528,230.5	2,290,807.8	42,090.0
2019	66,081.2	75.6	5,015,286.3	2,607,948.9	2,357,184.6	72,540.0
2020	66,839.7	80.6	5,390,277.3	2,417,539.4	2,736,643.8	35,730.0
2021	95,954.1	93.6	8,983,548.0	3,954,557.8	4,580,711.1	41,805.4
2022	89,700.8	93.6	7,770,997.5	3,561,688.3	4,848,728.0	41,087.8
2023	95,219.1	93.7	8,276,411.2	3,765,093.0	5,116,744.8	40,370.3

Source: Own computation from CSA data.

3.7.2. Avocado production, Potentials, Opportunities and constraint in Ethiopia

Avocado production in Ethiopia has gained significant attention in recent years due to the fruit's growing popularity both domestically and internationally. Here's an overview of the current state of avocado production and utilization in Ethiopia:

Climate and Geography: Ethiopia's diverse climatic zones and altitudes make it suitable for avocado cultivation. The highlands, particularly in regions like Sidama, Southern Nations, Nationalities, and Peoples' Region (SNNPR), benishagul gumuz and Oromia, are known for their favorable conditions.

Varieties: The most commonly cultivated varieties in Ethiopia include Hass and Fuerte, which are popular for their taste and marketability.

Growth Trends: As global demand for avocados has surged, Ethiopian farmers have increasingly turned to avocado farming as a lucrative agricultural activity. This has been supported by government initiatives and investment in agricultural infrastructure.

Export Potential: Ethiopia has been working to boost its avocado export capacity. The country has started to see success in exporting avocados to various markets, including Europe and the Middle East, benefiting from its relatively low production costs.

Challenges: Despite its potential, the avocado sector faces several challenges, including limited access to quality seedlings, water scarcity, market access issues, and infrastructural deficiencies.

Utilization

Domestic Consumption: In Ethiopia, avocados are consumed fresh, incorporated into salads, and used as spreads, particularly in urban areas. The nutritional benefits of avocados are becoming more recognized among consumers.

Culinary Uses: Apart from being eaten fresh, avocados are used in various traditional and modern dishes. They can be blended into smoothies or used in sauces, and are increasingly featured in health-oriented diets.

Export Use: A significant portion of avocado production is aimed at export. This includes processing avocados for products like oil and puree, though these value-added products are still in the early stages of development in Ethiopia.

Economic Impact: As avocado production grows, it contributes to rural employment and income generation. Farmers increasingly view avocados as a cash crop, which can improve household incomes and support community development.

Ethiopia's avocado industry is on the rise, with increasing production and growing recognition of its economic potential. With the right investments in technology, infrastructure, and market access, Ethiopia could become a significant player in the global avocado market, while also enhancing its domestic consumption and utilization of this nutritious fruit.

In Ethiopia, currently, 84,793.7 tons of avocado was produced on an estimated area of 19,758.75 ha of land with a productivity of 4.2 tons/ha. Horticultural fruits generally have about a 2% proportion of the total crops. And Oromia region shares 34% area coverage and production contributing 34.6% in Ethiopia. And, in Ethiopia, there is high investment potential in horticulture with an estimated irrigable potential area of more than 767,300 hectares with several incentives. Therefore, the current avocado area coverage, production and productivity status is very small in relation to the existing production potential of the country. The data shows generally the existence of a large yield gap as compared to the world average requiring improvement in all dimensions. The existing local varieties under production in Ethiopia are low yielding potential and poor quality that can't fit the

consumers' demand for local and world market. This requires replacing the local with varieties of improved high yielding potential and quality.

Ethiopia has a comparative advantage in many horticultural commodities due to its favorable climate, proximity to European and Middle Eastern markets and cheap labor. However, the production of horticultural crops is much less developed than the production of food grains in the country. Moreover, reports show that about 2.4 million tons of vegetables and fruits are produced by public and private commercial farms which are estimated to be less than 2 percent of the total crop production. Avocado is among fruit crops of significant importance and with a potential for domestic consumption, export markets and industrial processing. To improve the avocado production and productivity in Ethiopia, recently it is recognized by the government and private investors as an important potential crop with multidimensional benefits. Because of this, some small projects are underway such as the "Smallholder Horticulture Project (SHP)" which has been implemented by the joint program by the Ethiopian government in collaboration with USAID Ethiopia and MASHAV of Israel to develop a competitive and sustainable fruit development sector focusing on establishing a base for the avocado export market from Ethiopia.

The recent (FAOSTAT, 2022) data revealed that avocado is produced globally on 858, 152 ha and production of 8,685,672 million tons showing about the productivity of 7 tons per ha. Besides this, the last ten years data shows avocado production and area coverage worldwide is increasing linearly. About 70% of production comes from Latin American countries followed by Africa (12%), Asia (14%), Europe (1.7%) and Oceania (1.4%) (FAOSTAT,2022). This indicates globally the production of avocado is increasing. Moreover, the (FAOSTAT, 2022) data indicated that the world 10 top largest producers of avocado include Mexico followed by Colombia, Peru, Indonesia, Dominican Republic Kenya, Brazil, Haiti, Vietnam and Chile. The area coverage and production in Mexico is significantly higher than the other producing countries.

Table 3:- Areas coverage by Avocado with production, yield, consumption in Ethiopia

PYear	Area (Ha)	Yield Qt/Ha	Production (Qt)	HH Consumption (Qt)	Sale (Qt)	Export (Qt)
2015	13,798.0	39.6	536,978.0	273,482.9	247,493.2	100.0
2016	13,665.5	39.4	538,246.0	255,882.2	267,562.1	550.0
2017	17,834.6	36.4	649,821.0	347,004.4	285,401.4	940.0
2018	18,021.1	45.2	814,318.0	434,438.7	362,127.2	513.0
2019	19,758.8	42.9	847,936.5	457,885.7	373,092.1	200.0
2020	20,875.8	50.1	1,044,919.2	475,542.7	529,251.6	840.0
2021	30,587.7	80.2	2,453,356.3	1,118,485.1	1,211,958.0	604.5
2022	29,421.7	83.1	2,051,363.0	950,743.9	1,337,117.4	640.7
2023	31,796.3	88.4	2,299,075.4	1,060,563.2	1,462,276.9	677.0

Source: Own computation from CSA data.

3.7.3.Papaya production, Potentials, Opportunities and constraint in Ethiopia

Papaya (Carica papaya) is a tropical fruit that is cultivated in several regions of Ethiopia, owing to the country's suitable climate and growing conditions. Here's an overview of papaya production and utilization in Ethiopia:

Cultivation Regions: Papaya is primarily grown in the warmer regions of Ethiopia, including areas in the Southern Nations, Nationalities, and Peoples' Region (SNNPR), Oromia, benishagul gumuz,and certain parts of the East and Northeast regions.

Growing Conditions: Papaya thrives in well-drained, sandy, loamy soils with a pH of 6-6.5. It requires warm temperatures and is sensitive to frost.

Varieties: Various local and improved varieties are cultivated, with some being selected for their sweet taste, size, and disease resistance.

Agricultural Practices: Farmers utilize both traditional and modern agricultural practices. This includes proper spacing, irrigation techniques, and pest management strategies to maximize yield.

Production per Yield: The yield can vary widely depending on factors such as cultivar, soil type, climate, and farming practices. With optimal conditions, farmers can achieve high production levels.

Food Consumption: Papaya is commonly consumed fresh, and its sweet flavor makes it a popular snack. It can also be incorporated into salads, smoothies, and desserts.

Nutritional Benefits: Papaya is rich in vitamins (especially vitamin C and A), antioxidants, and dietary fiber, contributing to its popularity as a healthy food option.

Culinary Uses: In addition to being eaten raw, it can be cooked in some traditional dishes, and its seeds are often used as a spice in certain cuisines.

Commercial Use: Papaya is also processed for juice, jams, and dried fruit, contributing to value-added production.

Medicinal Uses: In traditional medicine, papaya leaves and seeds have been used for various ailments, including digestive issues and as a remedy for certain diseases.

Economic Impact: Papaya farming can provide significant income for smallholder farmers and contribute to local economies. The fruit is often sold in local markets, and with increasing urbanization, demand for fruits like papaya is rising.

Pests and Diseases: Papaya is susceptible to pests such as the papaya fruit fly and diseases like papaya rings pot virus, which can affect yield and quality.

Market Access: Farmers may face challenges related to market access, including transportation and pricing.

Climate Change: Changes in climate patterns can affect water availability and overall growing conditions for papaya.

Papaya production in Ethiopia holds potential for improving local diets, generating income for farmers, and contributing to agricultural diversification. Efforts to improve agricultural practices, access to markets, and disease management can further enhance papaya's role in the Ethiopian economy and food security.

Papaya (*Carica papaya* L.) is a short-lived perennial plant in the genus *Carica* under the family of *Caricaceae*. It is among the most important fruit crops growing mainly in the tropical and warmest parts of subtropical regions of the world. Papaya fruits are very popular due to their high nutritive, medicinal and other multiple uses such as meat tenderizer (extracted papain), raw materials for cosmetics, soft drinks and food canning industries and it is one of the high value fruit crops.

In Ethiopia, papaya is one of the most important fruit crops, which is produced for fresh and processed local consumption as well as for fresh fruit export purpose. Like for other fruits, the demand for papaya is increasing steadily due to rapid population growth and changes in dietary habits, but its productions have not been expanded as the country's potential and market demand. In recent years, it has also attained great popularity primarily because of its easy cultivation, quick returns (early fruiting as compared to other fruit crops), adaptability to diverse soil and climatic conditions; it occupies significant positions in homestead, smallholder and commercial production for

home consumption and income generation. Currently, papaya covered about 4,010 hectares of land with total production of 59,205 tons in Ethiopia during 2018-2019 cropping season (CSA, 2019). According to CSA (2019) data, it was also indicated that the distribution of papaya across the country was only 3.34% as compared to other fruit crops despite its importance.

Table 4:- Areas coverage by Papaya with production, yield and consumption in Ethiopia

Years	Area (Ha)	Yield Qt/Ha	Production (Qt)	HH consumption (Qt)	Sale (Qt)	Export (Qt)
2015	2434.1	171.9	404,351.00	283,490.50	108,487.40	7,970.00
2016	3338	144.1	481,156.00	336,424.30	130,537.60	11,690.00
2017	3489.5	144.4	503,962.00	356,401.90	133,197.20	9,770.00
2018	3484.5	156	543,550.00	386,735.80	142,953.70	14,530.00
2019	4009.6	147.2	592,051.00	427,460.80	159,853.80	16,570.00
2020	3627.3	142.7	517,941.20	341,996.60	156,521.80	19,000.00
2021	5096.1	141.3	720,077.70	453,288.90	234,817.30	19,467.40
2022	4428.1	137.4	623,814.80	431,745.00	222,674.80	23,442.40
2023	5638.3	134.08	786,264.00	479,346.20	238,982.40	23,548.50

Source: Own computation from CSA 2014/15 to 2020/21

3.7.4.Lemon production, Potentials, Opportunities and constraint in Ethiopia

Lemon production in Ethiopia has been gaining traction due to the country's favorable climate and soil conditions, which are conducive to citrus farming. Below is an overview of lemon production, utilization, market access, demand, and supply in Ethiopia.

Climate and Soil: Ethiopia's diverse climatic zones, particularly in the highland regions, provide ideal conditions for lemon cultivation. The soils in these areas are typically fertile and well-drained, promoting healthy growth.

Cultivation Areas: Major lemon-producing regions include the Southern and Central parts of Ethiopia, particularly Oromia and SNNPR (Southern Nations, Nationalities, and Peoples' Region).

Farming Practices: Many farmers practice smallholder farming, often integrating lemon trees with other crops. Improved agricultural practices and access to training can enhance yield and quality.

Varieties: The most commonly cultivated varieties include Eureka and Lisbon, which are preferred for their better market acceptance.

Domestic Consumption: Lemons are consumed fresh, used in cooking, and incorporated into various beverages. The local population utilizes lemon juice for its health benefits.

Processed Products: There is an increasing trend towards processing lemons into juice, preserved products, and essential oils, although this sector is still in its infancy.

Export: Ethiopia has considerable potential for lemon exports, targeting markets in the Middle East, Europe, and Asia. However, the export share remains low compared to the potential.

Origin and Taxonomy of Lemon balm Lemon balm (Melissa officinalis L.) is one of the important medicinal and aromatic plants that belong to the Lamiaceae (mint) family. It is native to the Mediterranean basin and cultivated in many countries globally (Bonacina et al., 2017). Genus Melissa belongs to the Kingdom: Plantae, Family: Lamiaceae; and Subfamily: Nepetoideae, with numerous species. The most common species include Melissa axillaris, Melissa flava Benth, and Melissa officinalis L. (Taiwo et al., 2012). These species are found in the Mediterranean region, including central Asia, western Asia, southern Europe and northern Africa. The most common species under cultivation and which has commercial value and the characteristic lemony odor is Melissa officinalis L. and it is commonly referred to as 'lemon balm' because of its lemon-like flavor and fragrance (Tucker and Baggio, 2000).

Botanical Description of Lemon balm (Melissa officinalis L) is a perennial bushy and upright plant that reaches about 1 meter in height (Moradkhani et al., 2010). The leaves of the lemon balm are soft, hairy, 2-8cm long, veined, and the edges either toothed or scalloped (Turhan, 2006). The stem of the plant is erect, with branches; it is quadrangular and frequently glabrous, while the leaves are ovate in shape and they are etiolated. Flowers are white or pale pink, consisting of small clusters of 4 to 12 blossoms. Lemon balm is a cross-pollinating species and has completely perfect flowers with petals (Virchea et al., 2021).

The suitable agro-ecology for lemon balm production includes mid to highland areas with well distributed rainfall of 500-600 mm throughout the growing season, a temperature range of 15-35oc, sandy loam fertile soil with pH 4.5-7.6, and well-drained (Mihajlov et al., 2013; Moradkhani et al., 2010). Lemon balm grows in full sun, but also in partial shade (Janina, 2003) and the plant is sensitive to drought and requires irrigation during the dry season.

3.7.5.Tomato production, Potentials, Opportunities and constraint in Ethiopia

Tomato production in Ethiopia presents significant opportunities due to favorable climate conditions, growing domestic demand, and potential for exports. Here's an overview of the current situation regarding tomato production, the market landscape, and the opportunities within Ethiopia.

Climate and Geography: Ethiopia has diverse climatic zones suitable for tomato cultivation and almost in all regions tomato will be growing. Currently the regions those producing in large amount are; Southern Nations, Nationalities, and Peoples' Region (SNNPR), Oromia, and Tigray are known for their agricultural productivity.

Varieties: Various tomato varieties are grown, including both local and improved varieties. Improved hybrids tend to have higher yields, improved resistance to diseases, and better shelf life.

Cultural Practices: Most tomato farming is done using traditional methods, but there is an increase in the use of improved agricultural practices, irrigation techniques, and greenhouse farming, which can significantly enhance productivity.

Production Challenges: Challenges include pest and disease pressures, post-harvest losses, inadequate access to quality seeds and farming inputs, limited access to credit, and market access issues.

Domestic Market: The domestic demand for tomatoes is high as they are a staple ingredient in Ethiopian cuisine. The increasing urbanization and population growth contribute to rising consumption levels.

Market Structure: The tomato market consists of smallholder farmers, cooperatives, wholesalers, and retailers. Informal trading is common, and prices can fluctuate based on seasonal supply.

Export Potential: There is an increasing opportunity for exporting tomatoes, especially to neighboring countries. However, challenges such as quality standards, packaging, and logistics need to be addressed to enhance competitiveness in international markets.

Value Chain: The tomato value chain includes production, processing, distribution, and retail. Opportunities exist in value-added products such as tomato paste, sauces, and dried tomatoes, which can tap into both local and export markets.

Opportunities in Tomato Production

Investment in Infrastructure: There is a need for improved infrastructure in storage, transportation, and processing facilities to reduce post-harvest losses and enhance market access.

Adoption of Technology: Utilizing drip irrigation, greenhouses, and other advanced agricultural technologies can improve yields and reduce resource use.

Capacity Building: Training for farmers on best practices in pest management, soil health, and market trends can help improve productivity and quality.

Increased Use of Organic Practices: There is a growing consumer demand for organic produce, and transitioning to organic tomato farming could tap into this market segment.

Partnerships and Cooperatives: Forming cooperatives can help farmers gain better bargaining power, access resources, and improve their market linkages.

Government Support: The Ethiopian government has shown interest in enhancing agricultural productivity through various programs. Access to credit, subsidies for inputs, and support for research and development in agriculture can be leveraged.

Tomato production in Ethiopia is poised for growth due to favorable conditions and increasing market demand. By addressing the challenges and capitalizing on the opportunities in production practices, infrastructure development, and market access, both smallholder and commercial farmers can benefit from this lucrative sector. Additionally, fostering investment in processing and export capabilities could further enhance the sustainability and profitability of tomato production in Ethiopia.

3.7.6.Onion production, Potentials, Opportunities and constraint in Ethiopia

Onion production in Ethiopia offers substantial potential for growth, supported by increasing domestic demand, government interest, and investment opportunities. However, addressing the constraints faced by farmers is essential to unlocking this potential fully. With targeted interventions in capacity building, infrastructure development, and improved access to inputs, Ethiopia can enhance its onion production capabilities, ultimately contributing to food security and economic growth.

Onion production in Ethiopia has significant potential given the country's diverse agro ecological zones, favorable climate, and increasing domestic demand. Here's a comprehensive overview of the potentials, opportunities, and constraints related to onion production in Ethiopia:

Diverse Agro ecological Zones: Ethiopia has various climates and altitudes conducive to onion cultivation, allowing for the production of different onion varieties.

Growing Domestic Demand: As urbanization increases and diets evolve, the demand for onions in both local markets and major urban centers is on the rise.

Export Opportunities: With the right investments in quality and logistics, Ethiopia can tap into export markets, particularly to neighboring countries and the Middle East.

Government Support: There is increasing governmental focus on agriculture, with various initiatives aimed at supporting farmers in improving productivity and agribusiness development.

Research Institutions: Development of improved onion varieties and production techniques by agricultural research institutions can enhance yield and resilience against diseases.

Irrigation Potential: There are opportunities to expand irrigation infrastructure to support off-season and more sustainable cultivation practices.

Value Chain Development: Enhancements in the onion value chain, including better storage, transportation, and processing, can significantly increase profitability for producers.

Access to Credit: Financial institutions are increasingly looking to support agricultural ventures, which could provide farmers with the capital needed for inputs and technology investments.

Increased Investment in Agribusiness: The Ethiopian government and private sectors are recognizing the agribusiness potential, which can drive investment in research, infrastructure, and technology.

Cooperative Movement: Strengthening farmer cooperatives can help smallholder farmers access resources, share knowledge, and improve bargaining power in markets.

Utilization of Technology: Adoption of modern agricultural technology, including precision farming and mobile applications for market information, can improve productivity.

3.7.7. Red Orange, Valencia Orange, Pomegranate, watermelon, Cucumber and coffee production in Ethiopia

Ethiopia's agricultural sector, particularly in terms of fruit and coffee production, has significant potential to contribute to economic growth and food security. However, to fully realize these opportunities, addressing constraints related to infrastructure, climate change, market access, and

agricultural practices will be essential. Investments in research, infrastructure, and training farmers on modern agricultural techniques can aid in overcoming these challenges.

Ethiopia, known as the origin of coffee, has a diverse agricultural landscape that supports the production of various fruits and vegetables, including red oranges, Valencia oranges, pomegranates, watermelons, and cucumbers. Here's an overview of the potentials, opportunities, and constraints related to the production of these crops in Ethiopia.

Ethiopia has a diverse agricultural landscape, which provides a conducive environment for the production of various fruits and crops, including red orange, Valencia orange, pomegranate, papaya, avocado, watermelon, cucumber, and coffee. Each of these commodities has its own potential, opportunities, and constraints in the Ethiopian context.

Ethiopia has significant potential for diversifying its agricultural production through crops like red oranges, Valencia oranges, pomegranates, watermelons, cucumbers, and coffee. However, realizing these potentials requires addressing existing constraints, investing in infrastructure, training, and adopting modern agricultural practices to enhance productivity and market access. By leveraging these opportunities, Ethiopia can bolster its agricultural sector and improve the livelihoods of its farmers.

4. Market Analysis of the target Production

The parameter used for the analysis of market include structure of the market (domestic and foreign market) quantity, quality, shape, size, color, taste and price of the vegetable and fruit products, customers choices and income competition and price of related goods. These parameters are the determinants of demand for and supply of products.

The fruit market in Ethiopia presents numerous opportunities for growth, particularly in the context of export potential and changing consumer preferences. Focusing on sustainable practices, increasing supply chain efficiency, and tapping into health trends could benefit various stakeholders in the fruit sector.

Ethiopia has a diverse climate that supports the growth of various fruits and vegetables. The country's agricultural sector is a significant component of its economy, offering substantial opportunities for production and export, particularly with a growing local demand for fresh produce.

Ethiopia has a diverse agricultural sector, and fruits play a significant role in the economy and the diet of its population. Below is a detailed analysis of the demand and supply of specific fruits—banana, lemon, red orange, Valencia orange, pomegranate, papaya, avocado, watermelon, cucumber, and coffee—in Ethiopia.

Thus the following market analysis is given accordingly;

4.1. Demand Analysis

In most markets, consumers are demanding higher quality. This quality is no longer judged solely by size and appearance; aroma, flavor and nutrient value are now increasing in importance. This can be seen in the larger range of commodities on the retail shelves, the number of varieties of each commodity now offered, and reduction in seasonality of supply in developing country markets. The traditional term, quality, implies excellence or suitability for use and means different things to different groups. Suitability for use includes freedom from microbial and chemical contaminants. Understanding of consumer behavior is related to how it will be accepted in the marketplace (Sabbe *et al.*, 2009).

Consumer satisfaction is related to their view as to what constitutes quality, and this varies widely in different markets and is decided by familiarity, economic status and marketing. For many minor tropical fruits, familiarity in many temperate markets is a major limitation to expanding the market for tropical fruits, coupled to a consumer willingness to try new fruits.

Banana is the second most important fruit after orange by exceeding apple-mango and grape fruits for human consumption. Although the performance of the fruits and vegetable industry varies from country to country, the general trend around the world is thought to be one of practicing a number of strategic problems to develop the above mentioned fruits and vegetable production.

In most cases, a high price for a product is a direct reflection of a high quality and standardized products. However, the situation is the reverse one when we see the present scenario of high quality price relationship of vegetables and fruits in domestic and foreign market places. The envisage irrigation project is expected to accommodate the ill health effects by implementing a high -teen vegetable and fruit production system which are fresh in nature .

4.1.1. Demand Factors

- **Population Growth**: Ethiopia has one of the fastest-growing populations in Africa. With a current population of over 116 million, the demand for nutritious food, including fruits and vegetables, is expected to rise accordingly (World Bank, 2021).
- **Urbanization**: As urban areas expand, there is increased demand for fresh produce due to higher incomes and changing consumer preferences. Cities like Addis Ababa show significant growth in demand for a variety of fruits and vegetables.
- **Health Trends**: Growing awareness of health and wellness drives the consumption of fruits and vegetables, as consumers seek healthier diets to combat lifestyle diseases.
- **Cultural Factors**: Certain fruits, like bananas and tomatoes, are staple ingredients in Ethiopian cuisine, nurturing a continuous demand throughout the year.
- **Export Opportunities**: There is a substantial global demand for Ethiopian fruits, especially avocados and coffee. The export market can also influence domestic demand, as farmers may prioritize crops for foreign markets.

Ethiopia's agricultural economy heavily relies on livestock farming, including dairy production, honey production, and poultry operations. This analysis explores the demand and supply dynamics of these three essential agricultural sectors.

4.1.2. Quantitative Demand Analysis

- **Historical Consumption Data:**

Analyzing available data over the past few years can provide insights into consumer trends and preferences. For instance:

- **Banana:** As one of the most widely consumed fruits in Ethiopia, it's estimated that the average annual per capita consumption is around 25 kg.
- **Lemon:** Citrus consumption has increased, with lemons seeing a growth in demand due to their use in beverages and cooking; average per capita might be around 5 kg.
- **Oranges (Red and Valencia):** Generally, the average per capita consumption is about 10 kg for both types combined.

- **Vegetable Consumption:**

- **Tomato:** Essential in Ethiopian cuisine, average consumption could range around 20 kg per capita.
- **Onion:** Frequently used in cooking, estimated to be around 15 kg per capita.

- **Market Growth Rate:**

Analyzing the growth rate in consumption for these fruits and vegetables can indicate increasing demand. For example, if the market for avocados is growing at 15% annually, that can signal rising popularity and potential for scaling production.

- **Price Elasticity:**

Understanding how sensitive consumers are to price changes in these products can guide pricing strategy. Fruits with low price elasticity, such as bananas, might maintain steady demand despite price fluctuations.

Table 5:- Key Demand Indicators (Hypothetical Example)

Fruit/Vegetable	Estimated Annual Demand (Metric Tons)	Average Price (ETB/KG)	Demand Elasticity
Banana	1,200,000	10	Inelastic
Lemon	250,000	15	Elastic
Red Orange	150,000	20	Elastic
Valencia Orange	100,000	22	Elastic
Mango	50,000	35	Elastic
Papaya	70,000	18	Elastic
Avocado	30,000	50	Elastic
Tomato	300,000	8	Inelastic
Onion	250,000	7	Inelastic

4.1.3. Qualitative Demand Analysis

- **Consumer Preferences:**

Ethiopian consumers are becoming increasingly health-conscious, leading to a higher demand for fresh produce. The growing awareness of the health benefits of fruits and vegetables, including their role in preventing chronic diseases, is a driving force behind demand.

- **Cultural Factors:**

Fruits like bananas and oranges become a significant place in Ethiopian culture, often associated with traditional meals and social gatherings. On the other hand, tomatoes and onions are staple ingredients in various local dishes, solidifying their continued demand.

- **Urbanization Trends:**

With rapid urbanization in Ethiopia, there's a shift towards modern retail outlets and supermarkets, making fresh produce more accessible. This change not only affects the distribution channels but also diversifies the consumer base, leading to changes in buying habits.

- **Economic Factors:**

Economic growth in Ethiopia can contribute to increased disposable income, leading to higher demand for a variety of fresh fruits and vegetables as consumers can afford to diversify their diets.

- **Seasonal Variations:**

Seasonal factors also influence demand. For instance, watermelons might see a spike in sales during warm months, while citrus fruits may experience higher demand during holidays when festive meals are more common.

The demand for fruits and vegetables, particularly bananas, lemons, oranges, pomegranates, papayas, avocados, watermelons, cucumbers, tomatoes, and onions, is driven by a combination of cultural, economic, and health-related factors. An effective marketing strategy would involve educating consumers about the health benefits of these products, leveraging urbanization trends to enhance distribution, and responding to seasonal demands with an adaptable supply chain.

A comprehensive demand analysis in Ethiopia's fruit and vegetable market reveals, growth potential fueled by changing consumer preferences, economic improvements, and an evolving retail landscape, making it a promising area for investment and business expansion.

4.2. Supplies Analysis

Ethiopia is one of Africa's largest agricultural producers, with a climate conducive to growing a wide variety of fruits and vegetables. The country has favorable agro-ecological conditions that support the growth of various crops, including the specific fruits and vegetables listed. The supply analysis of fruits and vegetables in Ethiopia highlights the country's significant potential in agricultural production given its favorable climatic conditions and government initiatives. However, challenges related to infrastructure, technology adoption, and market access hinders optimal supply chain effectiveness. Continuous investments and reforms could enhance the potential of Ethiopia's fruit and vegetable markets.

As a major vegetable and fruit crop for investor and small holders, as major source of employment for farmers, and as a major foreign exchange earner from exports of the vegetable and fruit products and by products, all have a vital multi-sector role in the economies of many developing countries.

Moreover, currently there are many medium and large scale investors who produce all the fruit crops and vegetable in Benishangul Gumuz Region but their production capacity levels are so minimal that they couldn't be able to satisfy the ever growing demand of fruits and vegetable in the regional and national market live alone the international foreign markets. Although all rounded efforts have been made in increasing the volume of vegetable and fruit supply for foreign and domestic markets so as to make the price reasonable and affordable, significant progress has not been observed on the irrigation agriculture in the regional level. It is thus for this reasons that the promoter has shown an inclination and tendency to invest his money, knowledge and time in the production of each vegetable and fruits on large scale basis with the intension of filling the wider gap between the demand for and the supply of the crops for domestic markets as well as foreign markets by availing the price of it affordable in line with the consumer purchasing capacities

Recognizing the above situation the Benishangul Gumuz Regional state has stipulated rules and laws regarding the enhancement of the regions vast potentials of fruits particularly banana, Lemon and mango products for the purpose of domestic consumption as well as for foreign markets by adding values. Thus, this project is the main source of fruits and vegetables for the local industries which added value on fruit and vegetable production, and foreign markets as well.

The establishment and expansions of irrigation agriculture investment with high yield of the mentioned fruits and vegetables through applying irrigation technology is expected to narrow the gap between demand and supply. Therefore, the more the increase in the product, the more it satisfies the market which justifies that supporting the irrigation project through financial and technical based is investing on huge capital return.

4.2.1. Qualitative Supply Analysis

Overview of Fruits and Vegetables Supply in Ethiopia:- Ethiopia is one of Africa's largest agricultural producers, with a climate conducive to growing a wide variety of fruits and vegetables.

The country has favorable agro-ecological conditions that support the growth of various crops, including the specific fruits and vegetables listed.

- **Key Fruit Commodities:**
  - **Bananas:** Ethiopia is a significant producer of bananas, particularly in the southern and southwestern regions. Banana production serves both domestic markets and exports, with increasing interest in exportation to Europe and the Middle East.
  - **Citrus Fruits (Lemon, Red Orange, Valencia Orange):** Citrus cultivation has seen growth, with lemons and oranges being cultivated mainly in the central and northern regions. The increasing export demand for high-quality citrus fruits has motivated farmers to adopt better agricultural practices.
- **Key Vegetable Commodities:**
  - **Tomatoes:** This is one of the most widely cultivated vegetables in Ethiopia, with high local consumption. The production peaks during the rainy season, but post-harvest losses due to inadequate storage facilities remain a challenge.
  - **Onions:** Onion cultivation is prevalent, and it has established markets both locally and regionally, with exports increasing recently.
- **Supply Chain Challenges:**
  - Limited access to irrigation and modern farming techniques can result in reduced yields.
  - Infrastructure challenges, such as poor road conditions and inadequate market access, can lead to increased post-harvest losses.
  - Market fluctuations and price variability can affect farmers' incomes and sustainability.
- **Government and Institutional Support:**
  - The Ethiopian government has been focusing on agricultural development, including investments in irrigation, training for farmers, and improving market access. Programs aimed at increasing export readiness and quality assurance for fruits and vegetables are increasingly important.

4.2.2. Quantitative Supply Analysis

- **Production Volume Estimates**:- According to FAO, World Bank. (2020). "Ethiopia Economic Update: Weathering COVID-19.", Ethiopia Ministry of Agriculture Reports on Crop Production. And Ethiopian Coffee and Tea Development and Marketing Authority, the actual supply of fruit and vegetables for the market indicated as below;

  - **Bananas**: Approximately 1.3 million tons.
  - **Lemons and Oranges**: Combined production approximately 300,000 tons.
  - **Mango**: About 50,000 tons.
  - **Papayas**: Estimated at 60,000 tons.
  - **Avocados**: Approximately 30,000 tons.
  - **Tomatoes**: Around 400,000 tons.
  - **Onions**: About 300,000 tons.

- **Export Statistics (2019 data)**:

- Exports of fruits and vegetables have been on the rise, with approximately 200,000 tons of fresh fruits exported, generating over $200 million in revenue, emphasizing the importance of these products in generating foreign income.

The supply analysis of fruits and vegetables in Ethiopia highlights the country's significant potential in agricultural production given its favorable climatic conditions and government initiatives. However, challenges related to infrastructure, technology adoption, and market access hinder optimal supply chain effectiveness. Continuous investments and reforms could enhance the potential of Ethiopia's fruit and vegetable markets.

Table 6:- Export of Fruits & vegetables during 1997-2002.

Year	Volume of export net weight (kg)	value of export (Eth. Birr)
1997	60, 963, 127	157, 574, 759
1998	41, 869, 995	106, 571, 263
1999	49, 321, 829	147, 836, 179
2000	39, 906, 300	113, 680, 425
2001	95, 218, 104	246, 907, 823
2002	131, 971, 761	353, 185, 313

Source: CSA

The major market of the horticultural crops exports of the country have been the republic of Djibouti, the Middle East (Saudi Arabia, Israel, Yemen, etc.) and the European countries (UK, Italy, The Netherlands, France, Germany, Denmark, etc.)

The average annual share of Middle East has been increasing rapidly from 1,682,249 kg (2.76 %) to 66,124,633 kg (50.11%) between 1997 and 2002 in quantity of net weight export while that of European share was declining significantly in change between the same periods from 28.86 to 14.37% (Table 5). The share of the Djibouti market also showed a decreasing trend from 34.48% for 1997 to 17.91 % for 2002. Other than those mentioned markets, several countries were exercised as destination or importers of Ethiopian horticultural products like U.S.A., Somali Morocco, Sudan, Fiji, Republic of Korea etc.

4.3. Demand and Supply Gap

Conducting a demand-supply gap analysis for the fruits and vegetables market in Ethiopia involves examining current market conditions, demand patterns, supply availability, and the resulting gaps. Below is a quantitative and qualitative analysis of Demand-Supply Gaps based on Ethiopia's agricultural landscape.

Ethiopia is known for its rich agricultural resources and diversity of crops. This analysis focuses on the demand and supply of specific fruits (Banana, Lemon, Red Orange, Valencia Orange, Pomegranate, Papaya, Avocado, Watermelon, Cucumber, and Coffee) and vegetables (Tomato and Onion) based on World Bank (2020) Ethiopia: Agriculture Sector Review, FAO (Food and Agriculture Organization). (2021) Ethiopia's Agricultural Outlook as well as Ministry of Agriculture of Ethiopia (2023) Ethiopian Commodity Production Reports

4.3.1. Quantitative Demand and Supply Gap Analysis

Table 7:- Annual Demand and Supple Gap

Fruits and Vegetables	Estimated Annual Demand (Metric Tons)	Estimated Annual Supply (Metric Tons)	Demand-Supply Gap (Metric Tons)
Bananas	1,200,000	1,000,000	200,000
Lemons	150,000	100,000	50,000
Red Oranges	100,000	80,000	20,000
Valencia Oranges	120,000	70,000	50,000
Papayas	90,000	40,000	50,000
Avocados	60,000	20,000	40,000

Tomatoes	400,000	350,000	50,000
Onions	200,000	100,000	100,000
Total	**2,780,000**	**2,090,000**	**690,000**

4.3.2. Qualitative Demand-Supply Gap Analysis

- **Fruits:**
  - **Bananas:** Ethiopia produces a significant quantity of bananas, with a total demand estimated at 1,200,000 metric tons compared to a supply of 1,000,000 metric tons. This results in a gap of 200,000 metric tons, indicating a potential market opportunity for increased banana production and export.
  - **Lemons and Oranges:** The demand for lemons and both Red and Valencia oranges shows significant gaps, primarily due to insufficient cultivation practices and market access. For instance, while 150,000 metric tons of lemons are demanded, only 100,000 metric tons are supplied, resulting in a 50,000 metric ton gap. Similarly, Valencia oranges exhibit a 50,000 metric ton gap.
  - **Avocados:** Although a relatively new crop in Ethiopia, the increasing demand (60,000 metric tons) shows a substantial unmet demand, with only 20,000 metric tons produced locally.
- **Vegetables:**
  - **Tomatoes & Onions:** These staple vegetables show significant demand, with tomatoes having a demand of 400,000 metric tons versus a supply of 350,000 metric tons, resulting in a 50,000 metric ton gap. Onions exhibit an even larger gap of 100,000 metric tons, as demand heavily outweighs supply due to various factors, including post-harvest losses and limited infrastructure.

The overall demand for fruits and vegetables in Ethiopia reveals a significant gap of approximately 690,000 metric tons. This gap presents both challenges and opportunities. Efforts to enhance agricultural productivity through better practices, irrigation, and access to markets can help bridge these gaps. Additionally, investment in infrastructure—such as cold storage and transportation—would mitigate post-harvest losses and improve supply chain efficiency.

4.4. Market Destination

The promoter has identified that local market and export market is used to sell the vegetables and fruit products after well-equipped and fifth years of implementation as follos

- Local Market
  - ✓ Regional Level
  - ✓ Neighboring regions (Oromiya and Amhara regions)
  - ✓ Addis Ababa
- Export Markets will be conducted to south Sudan

4.5. Market Strategy of the integrated agricultural farm

Developing an appropriate market strategy for an integrated agricultural farm producing a variety of vegetables and fruits requires a tailored approach that considers target markets, competition, distribution methods, and effective promotional tactics. Here's a comprehensive market strategy suitable for the project under study:

- **Market Analysis strategy**

- **Target Market Segmentation**:
  - **Households**: Health-conscious consumers, families seeking fresh produce, and those interested in organic options.
  - **Restaurants and Food Services**: Local restaurants, cafes, and catering companies looking for fresh, high-quality ingredients.
  - **Retailers**: Local grocery stores and supermarkets that aim to offer fresher, locally sourced produce.
  - **Health and Wellness Stores**: Organic and specialty food retailers looking to stock diverse produce.
- **Competitors Analysis**

The fruit and vegetable market in Ethiopia is characterized by several key competitors and players operating across different segments of the supply chain. The competition can be categorized into local producers, exporters, wholesalers, retailers, and agro-industrial companies. Here are the main competitors in this market:

Key Competitors in Ethiopia's Fruit and Vegetable Market

- **Local Farmers and Cooperatives**:
  - Many smallholder farmers grow fruits and vegetables for local markets. Cooperatives often help these farmers' pool resources and access markets more effectively.
  - Examples include the **Oromia Coffee Farmers Cooperative Union**, which also engages in other agricultural production, including fruits and vegetables.
- **Export Companies**:
  - Several companies focus on exporting Ethiopian fruits and vegetables to international markets, particularly Europe and the Middle East.
  - Notable exporters include:
    - **Sierra Export**: Specializes in the export of fresh fruits and vegetables.
    - **Ethiopian Agricultural and Industrial Investment Development**: Engages in exporting a range of agricultural products.
- **Large-scale Commercial Farms**:
  - Some companies operate large-scale farms that produce various fruits and vegetables for both local and export markets.
  - Examples include:
    - **Abyssinia Integrated Farm**: Engages in large-scale production of fruits, particularly avocados and bananas.
    - **Hawassa Industrial Park Farms**: This area houses several agri-business companies that promote large-scale production.
- **Wholesalers and Distributors**:
  - Numerous wholesalers in urban areas like Addis Ababa play a crucial role in bridging the gap between farmers and retailers.
  - Markets such as **Merkato** in Addis Ababa serve as significant hubs for fruit and vegetable distribution.
- **Retail Chains**:
  - Emerging retail chains and supermarkets are also competitors in the fruit and vegetable market, offering competitive pricing and quality.
  - Examples include:
    - **Supermarket chains like Shoa Supermarket** and **Dashen Supermarket** that provide a variety of fresh produce.
    - **Saliteh Supermarket**, which focuses on fresh fruits and vegetables.

- **Agro-Processing Companies**:
  - Companies involved in processing fruits and vegetables to produce jams, sauces, or dried fruits also compete in the market.
  - Examples include:
    - **Harvest Fresh**: Engages in juice and other processed fruit products.
    - **East Africa Bottling S.C.**: Although primarily known for beverages, they source fruits for juice production.
- **Local Markets and Informal Vendors**:
  - Informal markets and street vendors play a significant role in the distribution of fruits and vegetables in urban areas, competing with formal retail and wholesale activities.

The Ethiopian fruit and vegetable market is diverse, with various competitors ranging from smallholder farmers to large agricultural enterprises. Each segment plays an essential role in shaping the overall market dynamics, and understanding these players is crucial for anyone looking to enter or compete in this market.

- **Product Strategy**

- **Diverse Offerings**: Emphasize variety (e.g., different types of tomatoes and onions, seasonal fruits) to attract a wide range of customers.
- **Quality Assurance**: Ensure high quality and fresh produce by adhering to best agricultural practices. Consider obtaining organic certification if applicable.
- **Product Bundling**: Offer mixed produce boxes (e.g., a box containing tomatoes, onions, and seasonal fruits) to encourage larger purchases and attract new customers.

- **Pricing Strategy**

- **Competitive Pricing**: Set prices competitively based on market research while ensuring they cover production costs and provide a profit margin.
- **Value Pricing**: Position your products as high-quality through branding and effective communication, allowing for premium pricing on organic or specialty items.
- **Discounts and Bundles**: Implement discounts for bulk purchases, loyalty programs, and seasonal promotions to encourage repeat purchases.

- **Place (Distribution Strategy)**

- **Direct-to-Consumer Sales**:
  - **Farmers' Markets**: Participate in local markets to build direct relationships with consumers and establish brand presence.
  - **On-Farm Sales**: Create opportunities for customers to visit and purchase directly from the farm.
- **Retail Distribution**:
  - **Local Grocery Stores**: Establish partnerships with neighborhood grocery stores and specialty food shops to have your products stocked prominently.
  - **CSAs (Community Supported Agriculture)**: Implement a subscription-based model where customers pay upfront for a seasonal assortment of produce.
- **Online Presence**:
  - Create an e-commerce website for direct online sales, incorporating home delivery options for added convenience.
  - Collaborate with local delivery services or larger platforms (like Instacart or Amazon Fresh) for wider reach.

- **Promotion Strategy**

- **Brand Development**:
  - Create a strong brand identity that resonates with your target audience. This includes crafting a compelling brand story focused on sustainability, community support, and fresh local produce.
- **Digital Marketing**:
  - Utilize social media platforms (Instagram, Facebook, Pinterest) to showcase your farm, highlight recipes, and interact with customers.
  - Invest in a professional website featuring a blog with articles about farming practices, nutrition, recipes, and farm updates
- **Content Marketing**:
  - Share engaging content regularly, such as recipes using your produce, cooking tips, or information about the benefits of eating fresh fruits and vegetables.
- **Community Engagement**:
  - Organize farm tours and educational workshops to educate the public about agriculture, sustainability, and healthy eating.

- **Local Advertising**:
    - Advertise in local newspapers, magazines, or community newsletters to reach potential customers in your area.
    - Collaborate with local influencers or food bloggers to promote your products through reviews or sponsored posts.

- **Customer Relationship Management**

- **Feedback Mechanisms**: Implement ways to gather customer feedback (surveys, social media engagement) to continually improve your product offerings and service.
- **Loyalty Programs**: Establish loyalty programs for returning customers, offering special discounts or early access to new products as an incentive.

By implementing this market strategy, your integrated agricultural farm will be well-prepared to reach its target audience effectively, differentiate itself from competition, and establish lasting relationships with customers. Continuous evaluation and adaptation of the strategy will be crucial to meet changing market dynamics and consumer preferences.

The Ethiopian Fruit- and Vegetables Marketing Enterprise (ETFRUIT for short) is a state trading organization established in April, 1980 under the Horticulture Development Corporation (HDC) of the Ministry of State Farm Development. ETFRUIT is a wholesale institution dealing with domestic and export trade of fresh fruits, vegetables, flowers, processed

The Ethiopian Fruit- and Vegetables Marketing Enterprise (ETFRUIT for short) is a state trading organization established in April, 1980 under the Horticulture Development Corporation (HDC) of the Ministry of State Farm Development. ETFRUIT is a wholesale institution dealing with domestic and export trade of fresh fruits, vegetables, flowers, processed horticultural products and some slice crops. The marketing operation of the enterprise includes the collection of products from production sites, transportation, storage, grading and quality control, packing and distribution of these horticultural, floriculture and spice crops (MSDF, 1984).

For efficient and effective distributions of inputs and outputs of the irrigation project, we aim at establishing and maintaining value chains. For this purpose, the enterprise in addition to legally export to the foreign market it will work in close collaboration with all relevant national and regional institutions, among which ETFRUIT would be the Main one.

4.6. Market Arrangement & Channels

Setting the right market arrangements and channels for distributing the produced integrated agricultural farm's products is crucial for maximizing reach and profitability. Here's a breakdown of suitable market arrangements and distribution channels for the verity products that the promoter follows:

4.6.1. Direct Sales Channels

- **Farmers' Markets**

The promoter follows selling directly at farmers' markets allows you to interact with consumers personally and foster loyalty in which it has a benefit of establish the project's brand, gather direct feedback, and sell fresh produce at a premium price.

- **On-Farm Sales**

The promoter also set up a farm store where customers can buy fresh produce directly from your property which has a benefit of providing transparency about the project's farming practices and increases consumer trust.

- **Community Supported Agriculture (CSA)**

It is known that consumers subscribe to receive a weekly or monthly box of assorted produce in return for an upfront payment which the promoter prefers that has a benefit of ensuring sales throughout the season, provides predictable revenue, and builds a community around your farm.

4.6.2. Retail Distribution Channels

- **Local Grocery Stores and Supermarkets**

As market channels the promoter also provide the vegetable and fruit products for partner with local grocery stores and supermarkets to stock your produce that has a benefit to increase visibility, access to a broader customer base, and the ability to sell larger quantities.

- **Specialty Food Stores**

Target stores that focus on organic, local, or specialty foods will also use as channels which has a benefit in which these stores often have customers who are willing to pay a premium for quality produce, which could include your fruits and vegetables.

4.6.3. Online Sales Channels

- **E-commerce Website**

The promoter will develop a user-friendly website where customers can order fresh produce and have it delivered to their homes for direct access to a wider market, convenience for customers, and the ability to showcase the entire product range.

- **Online Marketplaces**

The promoter will utilize platforms like Amazon, eBay, or local food delivery services (like Instacart) that has a benefit of access to established customer bases and infrastructure, enhancing exposure with less effort upfront.

- **Social Media**

The owner also uses leverage platforms like Instagram and Facebook to sell products directly or link to your e-commerce site which has advantage of engaging with consumers directly, creating a community, and utilizing social proof through customer testimonials and photos.

4.6.4. Institutional Sales Channels

- **Restaurants and Cafés**

The other channels that the promoter follow is establish direct relationships with local chefs and restaurant owners to supply them with fresh ingredients that have advantage for steady demand and higher volume sales, especially if your produce aligns with their culinary needs.

- **Catering Companies**

The promoter will also establish Partner that applies catering services that require fresh produce for events which has a benefit of getting high-volume orders and potential for long-term contracts.

4.6.5. Export Markets

The promoter also export its vegetable and fruit products to the neighboring country, South Sudan, to international markets, particularly for specialty items like specialty coffees, pomegranates, and organic vegetables which has a benefit of Accessing larger markets that may offer higher prices for quality products.

4.6.6. Distribution Partnerships

The promoter will work with local courier and logistics services to facilitate delivery, especially for online orders and CSA boxes and join food hubs or local co-operatives that aggregate products from multiple local farms.

To optimize your market arrangement and channels for your integrated agricultural farm, a combination of direct sales, retail distribution, online presence, and institutional partnerships is essential. This multi-channel strategy will enable you to maximize your reach, increase sales volume, and build strong relationships with your customers, helping to sustain and grow your agricultural business effectively. Regular assessment of each channel's performance will help you adapt and fine-tune your approach to meet changing consumer preferences and market conditions.

4.7. Price Analysis

The price of fruits and vegetable is mainly influenced by the export market and domestic supply of the products. Current market price of quintals of Banana, Lemon, Red and Valencia Orange, Papaya, Avocado, and Mango is Birr 2,000, 3,000, 2,500, 2,500, 3,000, and 4,000/quintal respectively while tomato and onion is sod at price of 1,500 and 2,000 birr respectively in which the average price was taken to be birr 3,200 for fruit and 1,750 for vegetables (as table 19). In similar manner, the current price of Vegetables that includes tomato and onion at Addis Ababa is birr 1,000 and 1,200/quintal respectively in which the birr 3,200 birr for fruit and birr 1,750 for vegetables of the average current cost at the get for the project (as table 19). Assuming transportation and other marketing costs, the farm gate price of birr 3,200 birr for fruit and birr 1,750 for vegetables respectively will be increased while directly exported to the world market or can be sold directly to consumers in the country.

4.8. Land Building and Civil Works

The total land owned for the irrigation farm is 250 Ha out of the land for production, the land allocated for fruit at the first year was 25 ha while 20 ha was used for vegetables and 10 Ha for construction including the road accesses and the remaining will be developed starting from the first year of production after obtaining the loan. Accordingly, it expected that the owner will develop 165 ha for the fruit and 20 ha for the vegetables while 15 ha for construction as the new land development in which the total land used for fruit to be 185 ha and the land used for vegetables will be 40 ha and the total land used for construction will be 25 ha. The land development cost of 11,800 birr/Ha was taken as the cost for land development in which the total cost becomes 2,950,000 birr while land lease rate in BGRS for rural land ranges about 540 Birr per hectares and was fixed to land lease cost of birr 112,000 per year.

Table 8:-Land Use Plant for 250 Hectares

Land allocated		Land Use Over 10 Years (Ha)									
Description	% of Land	1	2	3	4	5	6	7	8	9	10
Tomato (Existing)	4%	10									
Tomato (New)	4%	10									
Total Tomato	8%	20	20	20	20	20	20	20	20	20	20
Onion (Existing)	4%	10									
Onion (New)	4%	10									
Onion Total	8%	20	20	20	20	20	20	20	20	20	20
Total Vegetable	16%	40	40	40	40	40	40	40	40	40	40
Mango (New)	12%	30	30	30	30	30	30	30	30	30	30
Avocado (New)	14%	34									
Avocado (Existing)	2%	6									
Avocado Total	16%	40	40	40	40	40	40	40	40	40	40
Orange Both Valencia & Red(New)	14%	35									
Orange Both Valencia & Red(Existing)	2%	5									
Orange Total	16%	40	40	40	40	40	40	40	40	40	40
Banana (New)	17%	41.5									
Banana (Existing)	3%	8.5									
Banana Total	20%	50	50	50	50	50	50	50	50	50	50
Papaya (New)	5%	12.5									
Papaya (Existing)	1%	2.5									
Papaya (Total)	6%	15	15	15	15	15	15	15	15	15	15
Lemon (New)	3%	7									
Lemon (Existing)	1%	3									
Lemon (Total)	4%	10	10	10	10	10	10	10	10	10	10
Fruit (New)	64%	160									
Fruit (Existing)	10%	25									
Total Fruit	74%	185	185	185	185	185	185	185	185	185	185
Total Fruit & Vegetables	90%	225	225	225	225	225	225	225	225	225	225
Construction Sites	10%	25	25	25	25	25	25	25	25	25	25
Total Investment	100%	250	250	250	250	250	250	250	250	250	250
Note That:- The Vegetables are collected Yearly and it is b/c of that the land cleared is re-used for the new year again											

5. The project Area

5.1. Physical Features of the project

5.1.1. Location and Accessibility

The project is intended to be implemented in Assosa Zone of Beninishangul Gumuze regional state, west Ethiopia. Benshanguel Gumuz Regional State (BGRS) is one of the regions found in the northwest part of the country. It is located at 9 0 17 , to 120 6´N latitude and 340 10´ to 370 E longitude with its capital, Asosa city, found 665 kilometers away from Addis Ababa (BGRIO 2010). The total area of the region is 50, 380 km2 bounded by Amhara region in the north, Oromia region in the east, Gambella region in the south and the republic of Sudan in the west. It is administratively classified into three zones (Asosa, Kamashi and Metekel zones) and two special districts (Maokoma special district and Pawi special district). Including the two special districts, there are a total of 20 districts in the region. The total population of the region is projected at 711, 702 people in 2009 (CSA 2007). Based on their languages, five indigenous people (Berta, Gumuz, Shinasha, Mao and Komo), and settlers of different ethnic groups (Amhara, Oromo, and others) inhabit the region. The indigenous people constitute 57.47% of the total population in the region. The region is endowed with different natural resources and there is huge potential for agriculture. Farming, hunting, gathering of wild foods, traditional gold mining are some of the livelihood strategies of the indigenous people. Population density is sparse with a regional average of 14 people per square kilometer (CSA 2007). Agricultural land is abundant with a mean landholding size of 3.7 hectare.

Assosa Zone was named after the Assosa Sultanate, which had approximately the same boundaries. Assosa is bordered on the south by the Mao-Komo special woreda, on the west by Sudan, and on the northeast by the Kamashi. The largest town in this zone is Assosa. Its highest point is Mount Bambasi, located in the woreda of the same name. The majority ethnic group in the zone is the Berta people. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), this Zone has a total population of 310,822, of whom 158,932 are men and 151,890 women. 39,957 or 12.86% of population are urban inhabitants. A total of 72,879 households were counted in this Zone, which results in an average of 4.27 persons to a household, and 69,378 housing units. The four largest ethnic groups reported in the Asosa Zone were the Berta, Oromo, Amhara and Tigrayans. The majority of the inhabitants were Muslim, with 74.08% of the population reporting

that they held that belief, while 16.51% practiced Ethiopian Orthodox Christianity, and 8.57% were Protestant. Mixed farming (crop production and livestock rearing) is the predominant sources of livelihood for the majority of the population in the area. The crop production is dominated by rain fed agriculture while irrigation is practiced on small-scale level using traditional stream diversion methods to produce some legume crops. The major crops produced in the district are: sorghum, maize, teff among cereal crops, haricot bean, noug, soya bean, sesame among oil crops, and horticultures are tomato, onion, pepper, head cabbage, carrot, potatoes, sweet potato, mango, banana, papaya, avocado and cazamiro. Moreover, livestock rearing is another agricultural activity practiced in the area. The major livestock reared in the district are cattle, donkey, goats, sheep and poultry (ADOoARD, 2018). This project is aimed toward generation of regular revenue through raw milk, cake dung and improved heifers production in Assosa zone.

The investigation area under consideration is found in the western part of the Benishangul Gumuz Region bordering Sudan in the west and oura woreda in the north. Moreover, specifically the target kebele Tsore Almetama are located around the southwestern margin of the Homosha Woreda as it is depicted on the figure 1 below. The selected Kebele can be accessed from the region (Asossa) through the asphalt road running from Asossa up to Homosha for about 36 km and then there is all-weather gravel road extending from Homosha up to Tsore Arumella rural Kebele.

5.1.2. Bio-physical Environment of the irrigation project District

Homosha woreda the project district is geographical with majority of the low land areas. As data from various source indicate that, the major parts of the Woreda is found in low land, in which the specific irrigation project is also found at low land geographic area of the locality. This shows that the project area is conducive environment for the proposed irrigation project.

5.1.3. Climate

According to the information from the Impact Assessment done by the Environmental project consultant the study areas fall in the ('Kola') climatic zone. There is no site specific rainfall data at the project site. However, the nearest stations to the project site found at Assosa. A 2 year (2013-2014) climatic data from Assosa shows, the average annual rain falls 1058.35 mm with a maximum of 1107.3 mm in 2014 and a minimum of 1009.4 mm in 2013. More than 93.6% of the total

rainfall occurs between April and October (*kiremt* season). Accordingly, the area is tropical and sub-tropical climatic nature that mainly important in production of the proposed Banana, Lemon, Apple-Mango and Onion. To use the rainfall during the summer time about 6.4 % of the total amount of rainfall occurs in the months of March, November and December. Maximum annual temperatures occur in February and March April from 31.8 to 31.85 ^{0}C whereas; minimum annual temperature occur in January with a value of $12^{0}C$ over the 2 years (2013-2014) which indicates that it is possible to harvest the products three times a year depending on both irrigation and rainfall mechanism.

5.1.4. Soil Type

The soil is highly weathered materials which is reddish to brownish in color. The district has different types of soils which are suitable for irrigation agriculture. Clay loam, among the soil types, found in the district covers 16.33% of the total land of the district, which has high potential for vegetable and fruit crop production. Sandy soil covers about 23.06% of the total land of the district. The other soil type Black soil, more convenient for Banana and mango production, exist in the district. Loam soil, which has good potentiality for irrigation agriculture and covers 42.8 % of the total land of the district. Majority of the soil in this project is black, brown and red which comprises about 80% and the rest of which are sandy soil. Black soil retains water that causes logging and may reduce the productivity of crop production. However, it is advantages during low rainy season. Therefore, the soil type found in the project site is more convenient for fruits and vegetable irrigation crop production.

5.1.5. Water Source

The rationale for selecting priority areas for drilling is the promising geology and the structural condition of the area. The proposed drilling site for Fikadu Integrated Farming is two sites for a maximum depth of 50-60m. The proposed site is located within farming site in between two stream junction that emit from the mountain at the 21m.

Identified priority areas for Detailing

The integrated agricultural farm has enough water source from two river stream with local name of Tsore River, as well as a total of 12 water ponds prepared for the dry season with a minimum capacity of 2700 cubic meter water each as well as a bore hole water prepared for this purpose will be used as

source of water. Moreover, the runoff water is also collected during the rainy seasons and used as additional source of water that indicates as many water points and potential feasible sites are identified in the study area. These sites are at different stream lines and local structures traced in the target areas of many small streams draining through/near Tsore Mountain to south-west direction.

Accordingly, the study from water potential by the water engineering consultancy revels that the source of the water is from four sources in which the two streams river, tsore rivers, is the first one with the capacity of 30 litter per second while the underground water in which two big drilled has been prepared will be the second source with a total capacity of 12 letter per second , the third source will be the water from the pond in which 12 ponds were prepared with a total capacity of 32,400 cubic meter (2700 cubic meter each) as well as the fourth source will be the water collecting from run off during rain water to big hall prepared at four site areas in which it was utilized by the situation during dry season.

Irrigation water can be sourced from groundwater or surfaces waters. Then, Fikadu Nemera Integrated Farming Investment, to drill one bore hole and construct pond for irrigation purposes to meet the present and future demand. The irrigation water will be obtain from underground water which drilling of bore hole using solar pump system to lift underground reservoirs and from stored reservoir by using gravity system to distribute pipe network to irrigate total net command area. To satisfy this required of water demands drilling of bore holes is choosing due to its quality, quantity and less cost than others. The required capacity of water is pumped by submersible pump from Bore hole to proposed reservoir and the material type is HDPE pipe with the diameter of 90mm (3") and 80mm (3'') GI pipe for inlet in to the reservoir and 3'' DCI pipe outlet, over flow and drain in to the reservoir. A pipe conveyance system for efficient movement of water from a source to the command area as well as land gravity is used in which Installing an HDPE pipe and fitting for irrigation system and the distribution system the hydrant is the outlet that the pipe or flexible hose can be connected to deliver irrigation water to the field.

According to the site investigation the available water from the ground water and the available pond of water is sufficient for irrigation system and irrigation takes place mostly in furrow and drips. The conveyance system consists of from constructed reservoir and from stored ponds to the command area. There is no constructing of diversion weir and irrigation canal structures but conveying the water through the river to the pond by gravity. The pipe network is designed for drip irrigation system.

From the practical point of view irrigation more than 12 hours in the project site at the initial is impossible. Hence to use the water flowing from in the river for the rest hours we made devices to store such waters to use the next day light periods, as there is scarcity of water during maximum demands. The 350m3 reservoir and eight available ponds are used as night storage. These night storage capacity are fixed when there is high demand to store during night period and to release or pump during day light period and used with in the day light flow water to irrigate the command area. Water Harvesting Pond: The farm ponds can be considered as water harvesting ponds. They may be dugout or embankment type. Their capacity depends upon the size of catchment area. Runoff yield from the catchment is diverted into these ponds, where it is properly stored.

Water is conveyed from the proposed Under Ground reservoir to consumers by gravity system through 90, 75mm and, 63mm HDPE pipe material is used. For the design of water schemes the national and regional standards are thoroughly considered. Based on the program implementation the study and design document includes engineering design of water supply system.

Fig: - Lay out and road network

River water harvesting is used with the available of eight ponds on site. This harvesting water at the pond is used the water during at the shortage of water available dry season for irrigation purpose.

The Available irrigation system is using the water pumping from the bore hole to Reservoir and by gravity system to irrigate the command area.

Available structure constructed on sites is

- ✓ The irrigation pipe line sizes are
  - Transmission main from Bore Hole to reservoirs are HDPE Pipe OD 90mm PN-16 (installed)
  - Distribution Networks are from OD 40mm-OD 90mm HDPE Pipe PN-16 (installed)
- ✓ Underground reservoir
  - 360m3 underground reservoir (constructed)

- ✓ Power Requirement
  - Solar pump (installed)

The solar panels collect sunlight, the controller regulates the power, and the pump moves water to where it's needed. Solar pumps have no emissions and little to no carbon footprint, contributing to environmental sustainability.

  - Standby Generator (installed)

- ✓ There is no irrigation structure like drainage canal , head work and irrigation structure
- ✓ Farm layout, farm blocks, road network, pipe network for irrigation is summited in the previous report and again to submit (constructed).

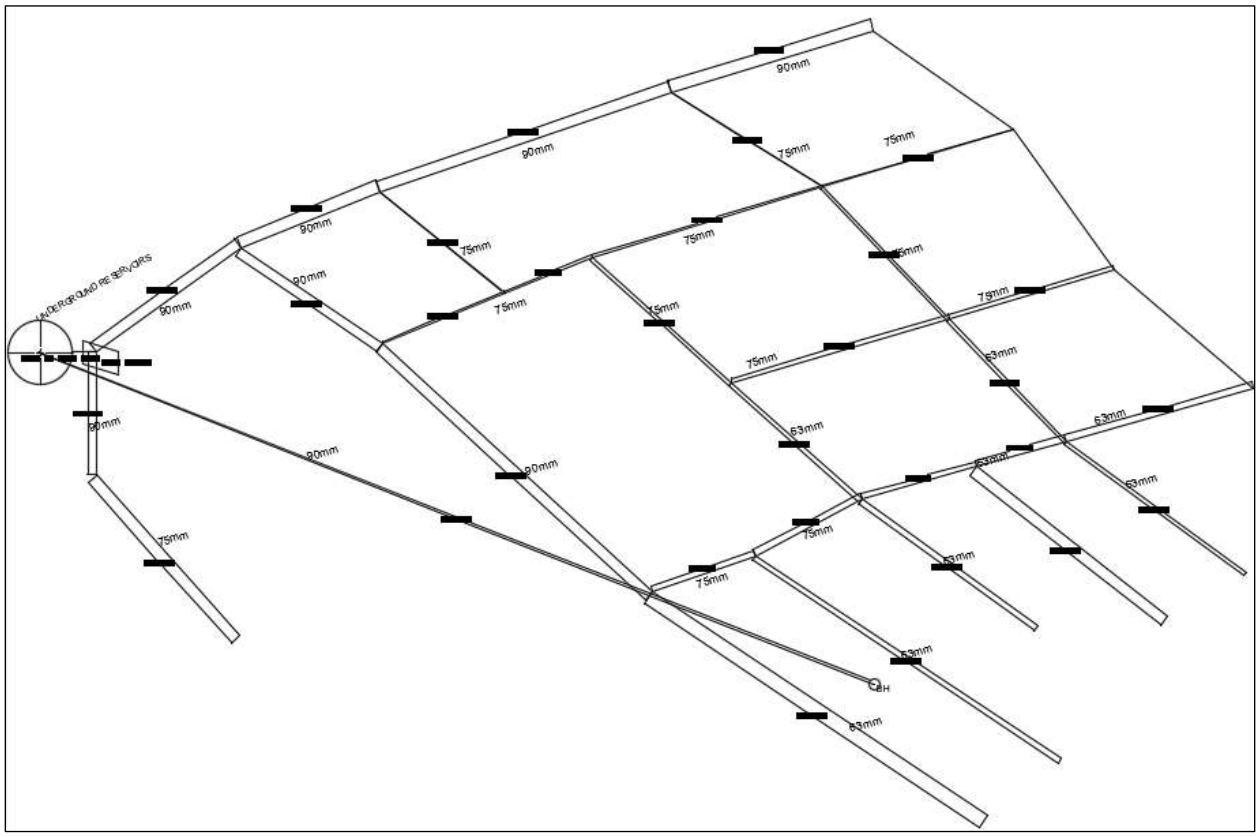
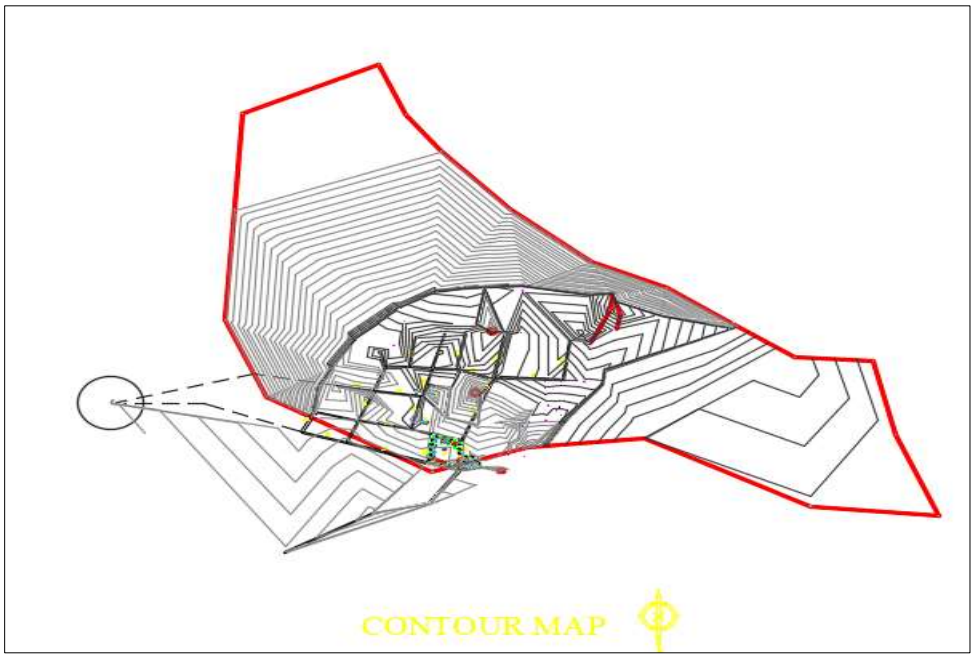


Fig: - Pipe network

- ✓ There is no pump station for irrigation but there is submersible pump to pumps from underground water to reservoir.
- ✓ Pipe, fitting, electric cable, switchboard and installation for planned bore holes based on hydrological study shall be submitted in the previous document under electromechanical BOQ.

- ✓ There is twelve water harvesting pond with the total average of 2760m3 capacity and it is sufficient during dry seasons.

The Contour map of the site is located as below;



5.1.6. Population and Migration

Population size, compositions, its spatial distribution and some other demographic and socioeconomic data are very important for planning, monitoring and evaluation of various development programs. According to the recent population and housing census report of CSA (2007) national census, a total population for the district will be estimated at 137,953 as of the current year (taking the regional population growth rate of 3 percent per year). Only about 9 percent of the woreda population is estimated to be urban dwellers. Moreover, according to the report from the field management study made, no populations are affected living below the irrigation project area.

6. The project

6.1. Project Objectives

The main objective of this integrated irrigation farm project is to produce two types of Vegetable and ten types fruit crop especially fruits that consists Banana, Lemon, Avocado, papaya, red and Valencia orange, and Mango as well as vegetables that consists onion and tomato in modernized irrigation agricultural system that ensure and improve high income of the promoter, develop access to the national and international market for the value added crops, improve the foreign currency deposit and support the economic Growth of the country. Thus, this integrated irrigation farm project will contribute towards creation of job opportunities to the local people; contributing toward increasing the foreign currency earning potential of the country through increasing exportable products, and improving the problem of natural resource management practices through creation of employment opportunity in the project area (as an alternative income generating non-farm activity for the local people).

6.2. Types of Technology Use

The integrated irrigation farm project aims at using irrigation technologies which are environmental friendly and which can be effectively utilized by locally existing knowhow with the exceptions of some machineries and equipment which should be imported if there is no domestic source of supply. Selection of the irrigation method is based on the consideration of Compatibility of the system, Economic considerations, Topographic limitations, Soil Characteristics, Water source (quality and quantity), Crop factors: economic-value, salt tolerance, and External influences **(**e.g. politics). Accordingly, by considering good land preparation, small scale and low initial investment, best suited on clay and loam soils, low slop surface areas, can access large quantity of water, and plan to use drip system and producing high value fruit and vegetable crops the irrigation type selected is **drip and surface irrigation method**. The irrigation project aims at utilizing locally available water is distributed over the field by gravity using solar energy generated system, a flow is introduced at a high point or along a high edge of the field and is allowed to cover the field by overland flow and canal construction technologies so as encourage the backward and forward linkage of the small scale irrigation project and hence contribute towards the realization of large scale Agricultural irrigation Development led Industrialization (ADLI) strategy of the country.

6.3. productions Capacity

For each fruits and vegetable crop types proposed, the integrated irrigation farm project aims at producing the maximum output per hectare and productivity level as proved to be achievable at the relevant research stations. The irrigation project promoters aim at utilizing the technologies and practices as per the recommendations of the research centers so as to produce the maximum output per hectare and productivity level. Accordingly, the projected output per hectare for each vegetable and fruits crop will be presented on Table 18 as below of the financial study part (projected output per hectare).

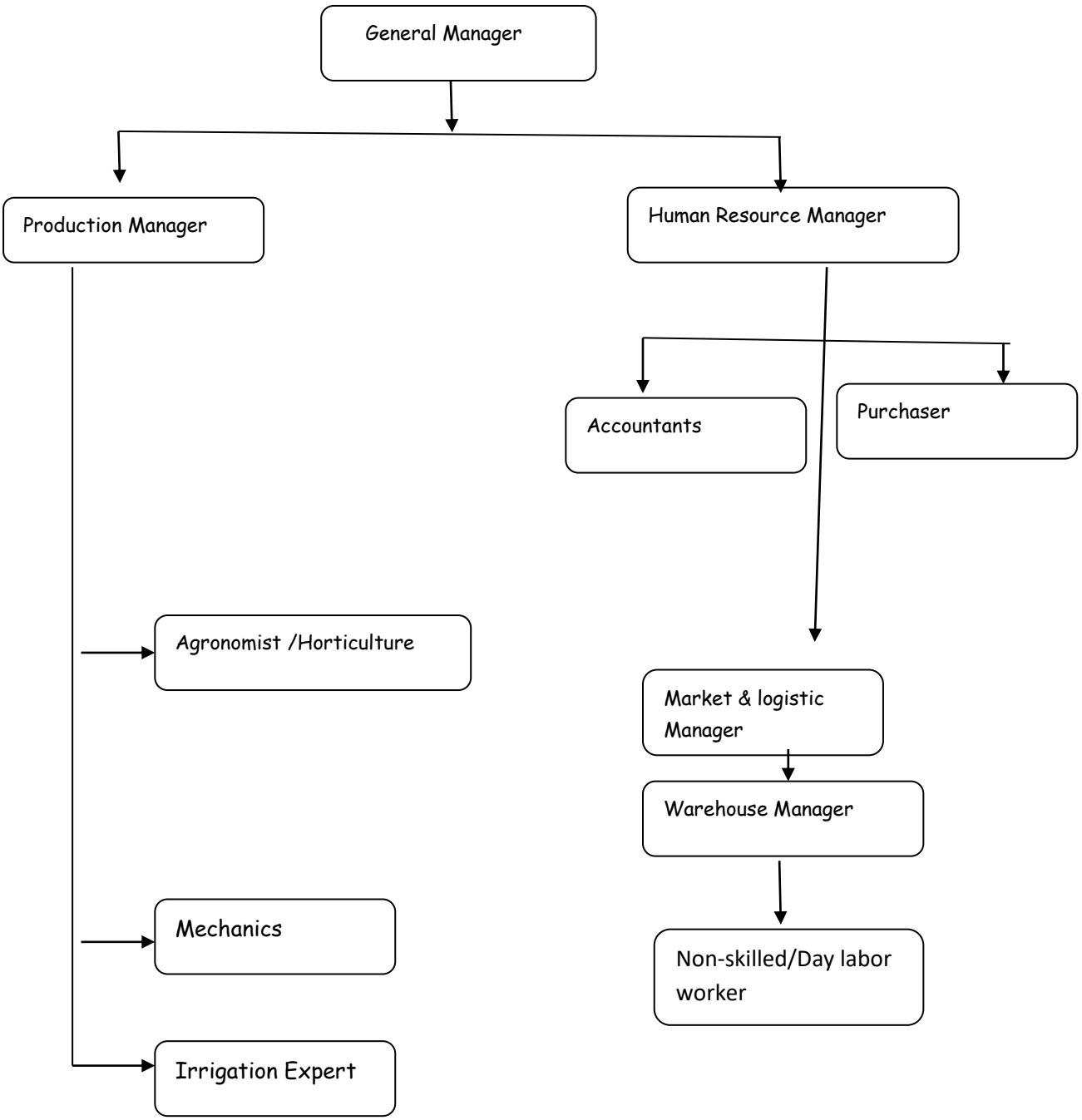
Table 18:-Forecasted Production each Vegetable and Fruit Crop as well as Productivity of the animal farm cases

Crops/Products	Year (G.C)	1	2	3	4	5	6	7	8	9	10
Vegetable	Land Area in Ha	40	40	40	40	40	40	40	40	40	40
	output in Ha (Average)	250	263	276	289	304	319	335	352	369	388
	Total output (Qnt)	10,000	10,500	11,025	11,576	12,155	12,763	13,401	14,071	14,775	15,513
Fruit	Land Area in Ha	185	185	185	185	185	185	185	185	185	185
	output in Ha (Average)	0	0	350	368	386	405	425	447	469	492
	Total output (Qnt)	-	-	64750	106357	117258	129277	142528	157137	173244	191002
1. Banana: Approximately 300-400 quintal per hectare in irrigated areas.											
2. Lemon: About 100-150 quintal per hectare.											
3. Red Orange / Valencia Orange: Ranges from 150-200 quintal per hectare.											
4. Mango: Yields of around 150-200 quintal per hectare.											
5. Papaya: Approximately 300-400 quintal per hectare under optimal conditions.											
6. Avocado: Between 100-150 quintals per hectare, with higher yields reported for certain varieties.											
Accordingly, the Average Yield amount for the nine fruit have taken as 350 quintals per hectare											
1. Onion: Generally, about 100-200 quintal per hectare.											
2. Tomato: Ranges from 200-400 quintal per hectare.											
Accordingly, the Average Yield amount for the two vegetables have taken as 225 quintals per hectare											
Source:- (FAO) Statistical Database, Ethiopia's Ministry of Agriculture reports, and Research papers focusing on Ethiopian agricultural production at the Regional Agricultural research center											

7. Organizational structure and Management

The organizational structure of this project is presented as;

Fig 2:-Organizational Structure of **Fikadu Nemera Waqo Integrated** Agricultural development Enterprises



Note that: - the above organizational structure shows the overall flows of accountability and reporting structure of the project staffs.

7.1. Manpower Requirement with Qualification

Manpower is the decisive for the successful implementation and operation of any project. Hence, careful identification of number and qualification of the manpower of the project is in order. Accordingly, the following table shows the manpower requirement with qualifications for the project;

Table 5: Project Manpower Requirement

S.N	Position	Number	Salary/Month	Total Monthly	Total Annual
1	General Manager	1	50,000	50,000	600,000
2	Agro-Economist	1	35,500	35,500	426,000
3	Finance & Administrative Head	1	25,000	25,000	300,000
4	Irrigation professional	1	35,500	35,500	426,000
5	Secretary-Cashier	1	15,500	15,500	186,000
6	Store-Keeper	1	15,200	15,200	182,400
7	Foramens	1	24,500	24,500	294,000
8	Machinery & Equipment Supervisor	1	15,500	15,500	186,000
9	Solar & Water pump Operator	1	22,200	22,200	266,400
10	Tractor Operator	3	18,000	54,000	1,944,000
11	Machineries Technician	1	20,500	20,500	246,000
12	Truck Driver	2	33,800	67,600	1,622,400
13	Light vehicle Driver	1	23,500	23,500	282,000
14	Guards	6	11500	69,000	15600
	Permanent Human Resource	22	-	0	-
	Total Payment		346,200	473,500	6,976,800
	Employment Pension Contribution		38,082	52,085	767,448

Note that the employees' salary is expected to increase by a minimum of five percent per each year, and also that the employer will pay pension contributions of at least 11 percent of the permanent employees' basic salary.

8. Financial Study

In this section, both the cash outflows requirements and the projected inflows are projected and analyzed.

8.1. Financial Requirements

The annual financial requirements of the project are classified as capital costs, operating costs or working capital requirements as follows.

8.1.1. Project Capital Costs

The irrigation project capital costs include such costs as irrigation structures construction costs, Machineries expenditures and farm equipment, and other costs which are supposed to be capitalized as cost of the irrigation project and are gradually depreciated over the life of the project. Accordingly, the following are the projected capital costs of the irrigation project summarized under different sections.

Irrigation structure Construction costs: - these include expenditures related with the constructions of such buildings as offices, toilet, and warehouse.

Table 6 :- Irrigation and Construction cost

S.N	Construction Needed	Area covered	Total Cost
1	Warehouse Construction cost	According to the Design BOK	10,623,283.78
2	Office	According to the Design BOK	6,208,711.05
3	Staff Residence	According to the Design BOK	8,399,132.43
4	Project Manager Residence	According to the Design BOK	4,921,457
5	Staff Café	According to the Design BOK	3,752,403
6	Staff Toilet & Shower Rooms	According to the Design BOK	5,387,009
7	Staff Clinic	According to the Design BOK	2,141,103
8	Guard House	According to the Design BOK	1,899,167
9	Car Parking & Shades	According to the Design BOK	1,361,991
10	Fence Work	According to the Design BOK	4,590,735
	Total Estimated Construction Costs		49,284,993

Note that: - the storage capacity of the warehouse to be constructed is 12,350 cubic meter for dry vegetables as well as 15,000 cubic meter for fresh fruit and vegetables

The equity asset of the owner from constructionis mentioned as follows;

	Equity Assets for Constructions		
1	Water Supply & Installation cost (Including Drill Water and reservoir construction)	According to the Irrigation Design BOK	25,423,261.00
2	Project Owner Residence	According to the Design BOK	5,316,979.57
3	Site Road Construction	According to the Design BOK	17,502,962.48
4	Pond Water Collection dam construction	75birr per m3 and an average of 2700m3 for each pond that becomes 32,400m3 for the total pond	2,430,000.00
	Total Equity Assets Cost		50,673,203.05

As the above table the promoter has constructed 3 building at its first phase works that includes Water Supply & Installation cost (Including Drill Water), owner residence room, pond construction as well as Site Road Construction in which the owner invest a total of **50,673,203.05** birr that will be used as equity assets for the Bank.

Farm machineries and Equipment: - The list of machinery and equipment of the irrigation project is indicated in Table 7 below. The total cost of machinery and equipment is estimated at Birr 22,442,932 out of which 187,024 dollar will be required in foreign currency if the machineries can't found in the country.

Table 7: New Machineries and Equipment

S.N	Description	Number	Birr/unit	Total (Birr)
1	Heavy Duty Tractor	2	6,000,000	12000000
2	Disc Plough	2	925,260	1850520
3	Disc Harrow	2	2,263,600	4527200
4	Mounted Ditcher	1	595,000	595000
5	Tine Cultivator	1	862,000	862000
6	Mounted Ridger	1	756,546	756546
7	Seed Drill	1	1,851,666	1851666
	Estimated Machineries		13,254,072	22,442,932

Note That:- Machineries that includes Rotivator (Slasher), Leveler, Sub-Soiler, Trailer, Trans-Planter and Sprayer will be fulfilled by the owners him self and don't included under the list

Note That; - the promoter also purchased solar powered water supply and install it on the project site, previously purchased one tractor that he will also use them for the expansion project and required to be used as equity asset for its future loan utilization in which the total price is birr 5,876,325 and indicated as follows;

	Equity Assets for Machineries			
	Asset	Number	Unit Price	Total Price
1	Solar Powered Water Supply cost	1	3,201,325	3,201,325.15
2	Solar Installation cost	Misslinous	500,000	500,000
3	Tractor	1	2,175,000	2,175,000
	Total Equity Assets Cost		5,876,325	5,876,325

Vehicle cost: - in addition to the above mentioned needed farm machineries, the enterprise need the following vehicles

Table 8:- Vehicle cost

S.N	Description of the Items	Unit	Birr/Unit	Total (Birr)
1	New ISUZU FSR With Cargo	1	7,500,000	7,500,000
2	FSR with Refrigerator/VAN for Vegetables	1	8,300,000	8,300,000
3	Pick Up	1	14,000,000	14,000,000
	Estimated Vehicle		29,800,000	29,800,000

As shown in the above (Table 7 & 8) two tractors are planned to cultivate the 250 ha of land three times a year with its accessories (Disc plough, disc Harrow and Ridger) hence it is enough to cultivate up to 100 ha with only one tractor. The planned ISUZU FSR is mainly used for transporting the huge amount of the products obtained and inputs needed for the five types of the project; vegetable, fruit, beekeeping farm, poultry farm as dairy farming. In addition to this, the cargo with Van/refrigerator is mainly planned to be purchased as the farm includes dairy farm which is mainly milk as it easily be infected. The Toyota double cabinet car is planned hence there is manager recruited to regular monitor and follow up the day-to-day progress of the irrigation project while the FSR and FSR with Refrigerator is needed to transport the products to the nearby market places to minimize the cost of transportation.

Note that: - the Promoter also has vehicle equity asset from the previously implemented project at 65 ha land that he has one purchased one Toyota Single Cup with a total cost of birr 2,700,000 as indicated below;

	Equity Asset at Hand for Vehicles	Quantity	Unit Price	Total Price
	Toyota Single Cup	1	2700000	2,700,000.00

Furniture and Fixture:-the flowing table shows the prices of office furniture and fixture at the time of preparing this project;

Table 9:- Furniture & Fixtures Cost				
S.N	Items	Number	Unit Cost	Total Cost
1	Desktop Computers	4	85,000	340000
2	Printer	4	45,500	182000
3	Photocopy Machines	1	120,000	120000
4	Shelves	8	10,350	82800
5	Managerial Chair	2	35,000	70000
6	Secretarial Chair	1	1,000	1000
7	Gust Chair	8	25,000	200000
8	Gust Tables	2	25,500	51000
9	Computer Tables	2	6,650	13300
10	Cash Register tape	1	15,000	15000
	Estimated Cost of Office Equipment			1,075,100
Note That:- Farm tools, equipment and other materials that includes Garden Fork, Shovel, Hoe, Rake, Weed Puller, Mulching Equipment, Scissors, Trolleys and Packing Tools has been fulfilled with the Owners based and don't need this equipment				

Land Clearing & Development costs: - Land Clearing & Development that includes plough (1st phase to 2nd), seeding, weeding chemical spray, harvesting, Cutting, Collecting, Packing, Conservation & environmental protection. Accordingly, the total land clearing development cost of the irrigation project land is calculated as shown by the following table. Accordingly, the total land clearing and development cost of 250 ha of land is estimated to be Birr 2,950,000 as indicated below.

Table 10:- Land Cleaning & Preparation cost					
Year	1	2	3	4	5
Investment Land	250	250	250	250	250
Vegetable (Tomato & Onion)	40	40	40	40	40
Fruit (Lemon, Red & Valencia Orange, Papaya, Banana, Avocado, and Mango)	185	185	185	185	185
Camp Construction (Office etc)	25	25	25	25	25
Developed Land	250	250	250	250	250
To be Developed	0.0	0.0	0.0	0.0	0.0
Land Development Cost/ha	11,800	11,800	11,800	11,800	11,800
New Development (11800/ha)	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000
Total Land Development Cost	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000

Note that: - out of the total 250 ha, the owner has developed a total of 120 at the present in which the cost spent on this case will be used as equity asset 1,416,000 birr

8.1.2. Project Operating Costs

The operating costs refer to those costs which are not included in the irrigation project capital costs and hence are not subjected to periodical depreciation. These costs include such costs as

labor costs, costs for equipment operations and maintenance such as fuel cost and repair and maintenance costs; depreciation costs, utilities expenses such as water bill, electricity bills and telephone charges; employments salary, Pension Contributions, utilities and others miscellaneous expenses. The overall project operating cost of 134,820,984 birr and is indicated on table 20 (annexed).

Labor costs: - labor required to cultivate a hectare of each crop is first determined to calculate labor cost. Accordingly, tables Table 13 & 14 (annexed) of labor required and labor cost needed respectively indicates the labor requirement per hectare, total labor required for each crop, the annual labor and average wage of the project needed a total labor of 1210 day labor worker per working day is required to prepare the total land of 250 ha starting from the first year of production. We have taken Birr 350.00 as the average wage per day per worker applicable to the project location which resulted in birr 61,600,000 wage cost per year. The average work-day is projected to increase by minimum of 5 percent each year. This is determined by considering the change in the labor market price over the past few years and the labor needed as well as the cost is indicated on tables Table 13 & 14 (annexed).

Supplies costs: - such integrated irrigation farm costs include costs for technological inputs such as fuel cost for the tractors, fertilizers, seeds, nursery seedlings, and other chemicals. Table 15 (annexed) shows the detailed calculations. As usual, we expect these cost items to increase by a minimum of 5 percent per year. Note that fertilizer is started to be applicable starting from the second phase of production year.

The inputs and fuel costs summarized is shown as below and the detailed supplies price is annexed as table 15

Description	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Inputs Cost	47,537,900	49,914,795	52,410,535	55,031,061	57,782,615	60,671,745	63,705,333	66,890,599	70,235,129	73,746,886
Fuel Cost	11,270,000	11,833,500	12,425,175	13,046,434	13,698,755	14,383,693	15,102,878	15,858,022	16,650,923	17,483,469
	58,807,900	61,748,295	64,835,710	68,077,495	71,481,370	75,055,438	78,808,210	82,748,621	86,886,052	91,230,355

Moreover, the seedling preparation cost is included under the supplies cost while the Asset fruit valuing cost is calculated to be 11,250,000 birr which has been taken with the reference of annexed as Annex-1 of this feasibility study part and the value is indicated below;

Equity Assets of Valuation cost of Fruit			
Description	No	Unit Cost	Total Equity Cost
Existing Asset Valuation cost of fruit	9,375	1200	11,250,000.00
Total Equity			11,250,000.00

Note also that:- there are around 9,375 planted fruit of excising assets valuation cost of fruit found on the 25 ha land of the fruit that each of estimated with price of 1200 birr and cost a total of 11,250,000 that will be used as equity contribution for the promoter as indicated on the table below;

Repair and maintenance costs: - are estimated as present of cost of constructions and furniture and fixture, 5 percent of costs of machineries and equipment and 10 percent of the costs of vehicles. Accordingly, table 11 below shows the detailed calculation.

Table 11:- Estimated Yearly repair & Maintenance Expense

Item	Cost	Percent of Cost	Repair & Maintenance Expense
Irrigation and Construction	49,284,993	2%	985,700
Machineries & Equipment	22,442,932	5%	1,122,147
Furniture & Fixture	1075100	2%	21,502
Vehicle	29,800,000	10%	2,980,000
Total Annual Repair & Maintenance Expense	102,603,025		5,109,348

Utilities expenses: - The major utilities of the envisaged project are electricity, fuel consumptions and telephone expense. The annual consumption and cost of utilities is indicated in table 12 below which estimates a total annual cost of Birr 680,000 and is expected to increase by a minimum of 5 percent per year.

Table 12:-Utilities & Miscellaneous Expense

Year	1	2	3	4	5	6	7	8	9	10
Utilities Expense	680,000	714,000	749,700	787,185	826,544	867,871	911,265	956,828	1,004,670	1,054,903
Miscellaneous Expense/Pre-operating cost	585,000	614,250	644,963	677,211	711,071	746,625	783,956	823,154	864,311	907,527
Land Lease (Birr 450/Ha)	112,500	112,500	112,500	112,500	112,500	112,500	112,500	112,500	112,500	112,500

Miscellaneous expense/Pre-operating Cost: - expense for which it is neither economical nor convenient to give specific account code and hence should be merged together under "miscellaneous expense" which includes entertainment expense, employee benefits, litigation expense and other pre-operating expenses. Similar to the utilities expense, such expense are estimated to be Birr

585,000 for the first year and expected to increase at least by 5 percent per year. This is presented by table 12 above.

Accordingly the total operating cost of the above expense that includes the mentioned costs can be summarized as working capital/Operational cost in this project case and indicated on Table 20 (annexed).

8.1.3. Total Financial Requirements

Total financial requirement for the integrated irrigation farm project is just the sum of the three costs we have determined above: total capital cost (fixed asset costs) and total operating cost as well as land clearing cost. The total project cost 240,374,009 birr in which the owner's equity (25%) is 60,093,502 birr and the bank loan (75%) will be 180,280,507 birr and is indicated on table 16 (below) summarizes the total finance requirement of the project together with the possible sources of finance which is expected to be financed by the project promoter and bank in the proportion of 25:75 respectively.

Table 16:- Total Irrigation Project Financial Requirement			
Item		Birr	
Irrigation and Construction cost		49,284,993	
Machineries & Equipment		22,442,932	
Vehicles		29,800,000	
Office Furniture & Fixture		1,075,100	
Total Cost of Fixed Assets		102,603,025	
Cost of New Land Clearing & Development		2,950,000	
Working Capital /Operating Cost		134,820,984	
Total Financial Requirement at first year (in Birr)		240,374,009	
Source of Finance			
Expected Owners Equity Contribution (25%)		60,093,502	
Bank Loan at 8.5%simple Interest rate (75%)		180,280,507	
Total Financial Requirement at first year (in Birr)		240,374,009	
Summary of Financial Requirement			
Item	Total	Equity	Loan
Irrigation and Construction cost	49,284,993	12,321,248	36,963,745
Machineries & Equipment	22,442,932	5,610,733	16,832,199
Vehicles	29,800,000	7,450,000	22,350,000
Office Furniture & Fixture	1,075,100.00	268,775	806,325
Cost of New Land Development	2,950,000	737,500	2,212,500
Working Capital /Operating Cost	134,820,984	33,705,246	101,115,738
Total Cost	240,374,009	60,093,502	180,280,507
		25%	75%

8.2. Estimated production

To estimate the per hectare production of each fruits and vegetable, we have utilized opinions of experts in the field of agronomist and horticulturalists. Accordingly, table 18 below shows the expected output in quintal of each fruit and vegetable crop proposed to be cultivated over the first ten years of the project life. Note that these projections are based on the expert opinions in the field as well as per the recommendations of agricultural irrigation research center found in the region. Here, it is expected that as the project operates for more number of years, there will be advantage of getting lessons from the past years and hence the latter years output per year is expected to increase accordingly. Moreover, as the project is irrigation projects the production begins at the third year for the fruits while first for the vegetable production and three times per year production had been considered.

Table 18:-Forecasted Production each Vegetable and Fruit Crop as well as Productivity of the animal farm cases

Crops/Products	Year (G.C)	1	2	3	4	5	6	7	8	9	10
Vegetable	Land Area in Ha	40	40	40	40	40	40	40	40	40	40
	output in Ha (Average)	250	263	276	289	304	319	335	352	369	388
	Total output (Qnt)	10,000	10,500	11,025	11,576	12,155	12,763	13,401	14,071	14,775	15,513
Fruit	Land Area in Ha	185	185	185	185	185	185	185	185	185	185
	output in Ha (Average)	0	0	350	368	386	405	425	447	469	492
	Total output (Qnt)	-	-	64750	106357	117258	129277	142528	157137	173244	191002
1. Banana: Approximately 300-400 quintal per hectare in irrigated areas.											
2. Lemon: About 100-150 quintal per hectare.											
3. Red Orange / Valencia Orange: Ranges from 150-200 quintal per hectare.											
4. Mango: Yields of around 150-200 quintal per hectare.											
5. Papaya: Approximately 300-400 quintal per hectare under optimal conditions.											
6. Avocado: Between 100-150 quintals per hectare, with higher yields reported for certain varieties.											
Accordingly, the Average Yield amount for the nine fruit have taken as 350 quintals per hectare											
1. Onion: Generally, about 100-200 quintal per hectare.											
2. Tomato: Ranges from 200-400 quintal per hectare.											
Accordingly, the Average Yield amount for the two vegetables have taken as 225 quintals per hectare											
Source:- (FAO) Statistical Database, Ethiopia's Ministry of Agriculture reports, and Research papers focusing on Ethiopian agricultural production at the Regional Agricultural research center											

8.3. Estimated Sales Revenues

Sales revenues are the functions of production and selling price per unit of each fruit and vegetable crop. Taking the projected production of selling price to each fruit and products of table 21 below, we now proceed to the projection of selling price of each fruit and vegetable crop. Accordingly, the selling price of each quintal of fruits and vegetable is expected to increase each year by a minimum of 5 percent. Given the trends of the past five years in Ethiopia in particular and in the world in

general, this projection wouldn't be far from the reality of the normal macroeconomic condition. In order to determine the forecasted sales revenues, we need to multiply the forecasted selling price per unit of each crop by their respective projected production of each fruit and vegetable crop per year as table 18 above and 19 below. However, it has to be noted that the revenue is mainly calculated starting from the third year as the full harvesting will be started at that time. The total revenue of the project, Table 21 is found at the annex this report.

Table 19: Projected Selling Price of a quintal of each crop per a year (at farm gate price in Birr)											
Year (G.C)	Description	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Vegetable	Average Price	1,750	1,838	1,929	2,026	2,127	2,233	2,345	2,462	2,586	2,586
Fruit	Average Price			3,200	3,360	3,528	3,704	3,890	4,084	4,288	4,288
The calculation is done by assuming the three times production of each vegetable crops per a year											
1. Banana: Approximately 1,000 to 2,000 Ethiopian Birr per quintal. **2. Lemon**: Around 2,000 to 3,000 Ethiopian Birr per quintal. **3. Orange (Red & Valencia)**: Approximately 1,500 to 2,500 Ethiopian Birr per quintal. **4. Mango**: Roughly 1,500 to 2,500 Ethiopian Birr per quintal. **5. Papaya**: Ranges from 1,500 to 3,000 Ethiopian Birr per quintal.											
6. Avocado: Approximately 3,000 to 6,000 Ethiopian Birr per quintal. **Average Price for Fruit is 3200 birr is taken** **1. Onion**: Approximately 800 to 1,500 Ethiopian Birr per quintal. **2. Tomato**: Roughly 1,000 to 2,000 Ethiopian Birr per quintal. **Average Price for Vegetables is 1750 birr** **Sources: -** Ethiopian Federal Ministry of Agriculture, Local market reports from the Ethiopian Commodity Exchange (ECX), FAO market reports and Local Market analysis											

8.4. Profit of one year

Table :-Profit of one Year

Particulars	**Amount in Birr**	
SALES: one year sales of farm products		228,471,359
Less		
Employments Salaries	6,976,800	
Pension Contributions	767,448	
Land Lease (Birr 540/ha)	112,500	
Labor Cost/Wage Cost	61,600,000	
Repairs & Maintenance	5,109,348	
Utilities Cost	680,000	
Supplies Cost	58,807,900	
Insurance Expense	224,558	
Miscellaneous Cost	585,000	134,863,554
Gross Profit/Operating Profit		
Tax Payable	47,184,244	
Net Profit Before Tax		46,423,561
Note That:- This Profit is obtained at the end of third year of production		

8.5. Depreciation Estimate

To determine the periodical depreciation, we adopted the Ethiopian standard of useful economic life of fixed assets and hence used depreciation rates for each asset category accordingly. The detail depreciation schedule is presented by table 22 (annexed). Depending on the difference in the useful lives of specific assets, the depreciation charge is estimated to be large at the beginning of the irrigation project life and smaller at the earlier years since some of the assets are expected to be fully depreciated within the first five years. The existing fixed assets are expected to have been in service for the last three years and hence their remaining useful time is determined accordingly.

8.6. Loan Repayment Plan and Interest Expense

The periodical interest expense is just the function of the amount of the loan outstanding at the beginning of each period, the interest rate and the time for which the loan remains unchanged. Accordingly, the outstanding bank loan after the additional finance was estimated to be Birr **180,280,507** at simple interest rate of 12.5 percent on the unpaid balance of the loan at the beginning of each period. The loan is expected to be paid with installment amount of Birr 18,028,051 over seven years starting just from the third year of operation as indicated on Table 23 (annexed).

8.7. Estimated Income Statement

Table 25 (annexed) shows the forecasted income statement of the irrigation project over the first ten years of the project life. Accordingly, the net income at the first year is observed negative as if the production of the fruits begins at the third year and it indicates that it is not profitable until second year. The income statement exhibits a net profit ranging between Birr 63,153,459 during the third year and Birr 2,329,981,937 during the tenth year of the irrigation project thereby generating average profit of Birr 856,676,240 over the first ten years.

8.8. Estimated Cash Flow Statement

As can be seen from table 26 (annexed), the cash flow analysis also reveals negative at the first year and positive net cash inflow starting from the second year production. Accordingly, a positive

net cash inflow of Birr 167,912,667 during the third year and Birr 2,496,072,223 during the tenth year of the project thereby generating average net cash inflows of Birr 888,002,240.

8.9. Estimated Balance Sheet

Table 27 (annexed) shows forecasted balance sheet of the enterprise for the first ten years of the life of the irrigation project. Note that as the projected balance sheet shows that the financial position of the firm remarkably improves over the period and will be able to full operate by own finance if the project is successfully implemented.

8.10. Overall Financial Assessment

When evaluated in terms of its profitability, there is steady increase in after tax net income starting from the second year of production showing that the project would remarkably contribute towards wealth maximization of the shareholders. Similarly, the forecasted balance sheet shows extraordinary attractive financial position of the firm over the same period. In addition , when viewed in terms of the sources and uses of money (cash flow statements), there is steady increase in the net cash provided by the irrigation project cash receipts after covering the cash payments required to sustain the project. Furthermore, the irrigation project has the following financial performance measured in different investment decision criteria. The following table shows the summarized project financial viability test just for the first ten years of the life of the project.

Table 29. project financial viability

Criteria		Results
Present value of benefits (starting from the third year)	PVB	63,153,459
Present value of costs	PVC	228,471,359
Net present value	NPV	291,624,818
Benefit cost ratio	BCR	1.97
Net benefit cost ratio	NBCR	0.97
Internal rate of return	IRR	67.5%
Rate of return on investment	ROI	1.5

Net present value (NPV):- is the sum of present values of all the cash flow both positive and negative that are expected to occur over the life of the project. NPV is an indicator of how much value an investment or project adds to the capital invested. In principal a project is accepted if the

NPV is non-negative. Accordingly, the net present value of the project at 8.5% discount rate is found to be Birr 291,624,818 which means that the project would contribute Birr 291,624,818 towards the wealth maximization of the shareholders wealth and hence it is viable.

Benefit Cost Ratio (BCR):- is defined as the ratio of the discounted values of benefits to the discounted value of costs. A ratio of at least one is required for acceptability and the ratio of one indicates that the NPV of zero at a particular discount rate. In this project case BCR of Birr 1.97 show, for every one Birr invested in this project the return would be 1.97 Birr, Which remarkable and acceptable figure.

Net Benefit cost Ration (NBCR):- this ratio is defined as the ratio of net present value to the present value of cost. A ratio greater than zero (0) is needed for the hurdle rate required to make the project financially viable.

Internal Rate of return (IRR):- is the annualized effective compounded return rate that can be earned on the invested capital, i.e., the yield on the investment. Put another way, the internal rate of return for an investment is the discount rate that makes the net present value of the investment's income stream total to zero. It is an indicator of the efficiency or quality of an investment. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments or putting the money in a bank account. Accordingly, the IRR is 67.5 present, which is to recover its investment and operating costs and still break even. It measures, which is to mean that the net cash inflows from the project will finance interest rate as high as 67.5 percent after covering all the necessary operating costs. Hence, the project is found to be extremely attractive when measured in terms of IRR criteria.

Rate of return on investment (ROI):- is the ratio of average net income over the ten years to the average investment is found to be 1.5 times the value of fixed investments, which shows very impressive performance of the project.

Accordingly, the BCR of this project 1.97, which means that cost can rise by 97 percent at which the BCR will become exactly 1.5. Thus, the 97 percent margin of safety is large enough to generate for the stability of the above decision criteria.

Similarly, revenues can keep dropping up to [1-(1/BCR)]=[1-(1/1.66)]=1-0.60=0.49 which is to mean 49 percent, keeping the cost elements constant by more than 49 percent may lead the project into rejection region. However, given the past few year trends, the price of these items have been increasing at increasing rate and hence expected to increase over the next many years due to increasing demand to these outputs and partly due to increasing general trend in commodity prices.

In general, when estimated both in terms cost and revenue, the project has adequate boundary of safety to guarantee the stability of the determined investment decision criteria above. Thus, *the project deserves financing when measured in term of all financial statement and viability tests.*

9. Irrigation Project Impact Assessment

9.1. Positive Impacts

Contribution to the agriculture sector: - as this small scale agricultural irrigation investment is expected to be implemented and managed in modern system, there is no shadow of doubt that it will positively contributed towards national agricultural production.

Contribution to balance of payment: - as most irrigation project output is expected to be vegetable and fruit crops which will be supplied to national and international market, it will boost the foreign currency earning and eventually contribute towards positive balance of payment.

Job Opportunity: - the production of such vegetable and fruit crop outputs would allow the expansion of other processing industries and factories in the surrounding urban areas creating more permanent job opportunities for people in the area. Thus, the implementation of this irrigation project is expected to have other sector linkages and hence forms synergy in socio-economic development of the country.

Supply of modern agricultural technologies: The irrigation project is also expected to supply modern agricultural irrigation technologies and practices which may change the farming practices of the local people from rain fed to small scale irrigation method.

Gender issues: Women as well as men benefit equally form the employment opportunities that will be created and from convenient and safe access road facility that are supposed to be constructed as the result of this irrigation project implementation. In addition, women often run income generating schemes in the area and during the constriction period, it is anticipated that there will be further income generating activities for women such as food catering/restaurants for workers on the construction sites, and the selling of local products to construction camp workers. These activates will benefit mainly women who are very often the sole supporters of their families. It is also recommended for the project promoter to give equal employment opportunities to woman as well as men within the project skills requirements, and to maximize the procurement of local products and services.

9.2. Potential Negative Impacts of the Project Implementation

This is one of the phases of the irrigation project where many environmental concerns should be taken in to account. The activities at this phase are site establishment and construction of infrastructures such as road, base camp, storage for farm inputs/chemicals and waste disposal pits. These activities would entail moderate loss to the environment. Hence, the proponent should consider the environmental concerns while undertaking the activities to keep its compatibility with environment. Accordingly, the potential impact and Generic Mitigation Measures that could be taken are listed as follows;

9.2.1. Potential Impacts

- Loss of vegetative cover, decrease in soil fertility
- Reduction in soil and groundwater quality, declines in plant growth and reduced harvests
- Fertilizer runoff leading to degradation of aquatic environments in nearby ponds, streams and other water bodies
- Health effects on workers
- Degradation of groundwater, streams, and rivers from solid and liquid wastes, and consequent
- Upsetting existing social and economic community management relationships, land tenure systems, security of livelihoods, and gender division labor
- Conflicting demands on surface or groundwater supplies
- Creating habitats in canals and ditches for disease carriers such as mosquitoes and snails
- Spreading infection and disease through the inappropriate use of irrigation canals for water supply, bathing or human waste disposal
- Health effects from improper storage, handling, use or disposal of agro-chemicals (pesticides, herbicides)
- Water logging, Stalinization and Erosion
- Reduced quality of surface and groundwater receiving excess irrigation water or drainage (nutrients, agrochemicals, salts and minerals)

9.2.2. Generic Mitigation Measures

- Assess ecology of disease carriers in the project area, and employ suitable prevention and mitigation measures, e.g.:
  - Site and orient water works, fields and furrows to ensure adequate natural drainage of surface water
  - Avoid unsuitable gradients, and creating stagnant or slowly moving water
  - Construct straight or only slightly curved canals
  - Install gates at canal ends to allow complete flushing
  - Ensure adequate sub-surface drainage of fields
  - Avoid over-irrigation
  - Maintain water works, and clear sediment and weeds, regularly
- Provide/ensure alternate facilities for domestic water supply, bathing and human waste disposal
- Training/supervision of farm workers on use of agro-chemicals to protect worker health and safety along with the environment
- Training of Integrated Pest Management (IPM) scouts for early recognition of pest outbreaks and the most environmentally sound methods to combat outbreaks
- Thoroughly assess project soils and their management needs under irrigated agriculture
- Apply water efficiently (consider drip or dawn/evening sprinkler system)
- Install and maintain adequate surface and subsurface draining
- Use lined canals or pipes to prevent seepage
- Design and layout of furrows appropriately
- Avoid unsuitable gradients
- Avoid over-irrigation
- Install sediment traps in fields and canals to capture sediment for return to fields
- Minimum tillage, contour cropping, terracing and other methods of conserving soil moisture
- Minimize risks of water logging and Stalinization
- Use agro-chemicals appropriately
- Prevent surface drainage of fields into nearby water bodies (streams, ponds, etc.
- Development of range management specialists in Agricultural Ministry

9.3. Risks during Vegetables and Fruit Production

9.3.1. Macro Level Risks

- **Economic Downturns** and Climate Change

Risk of Economic Downturns: - Reduced consumer spending can lead to lower prices for produce. Risk of Climate changes: Increased likelihood of extreme weather events, such as prolonged droughts or floods.

Mitigation Strategies:

  - Diversifying markets and crops as the owner is engaged with to reduce dependence on a single income source in which the project promoter cultivate ten types of fruit and two types of vegetables will be implemented
  - Implementing climate-resilient farming practices and crop varieties.

- **Market Fluctuations**

- **Risk**: Price volatility can affect profitability.
- **Mitigation**:
  - Diversify crops to reduce reliance on a single income source.
  - The project promoter will establish contracts with buyers or seek to participate in CSAs (Community Supported Agriculture).
  - The promoter will implement monitor market trends and adjust planting plans based on demand forecasts.

9.3.2. Sector Level Risks

- **Water shortage and Quality Issues**

- **Risk**: Contaminated water can affect crop health and food safety as well as compete for water with other sectors (e.g., industrial, residential).
- **Mitigation**:
  - Regularly test water sources for contaminants.
  - Implement treatment processes for irrigation water, if necessary.

- Avoid using wastewater from unknown or unsafe sources as the source of the water is from the owner land
- Developing water conservation practices and exploring alternative water sources as the project uses rainwater harvesting as well as establishment of 12 ponds that has an average capacity of holding 3,500 cubic meter water has been prepared by the promoter

➢ **Regulatory Changes**

- **Risk**: New regulations could impose restrictions on water usage.
- **Mitigation**:
  - Stay informed about local and regional water regulations.
  - Engage in water conservation practices to comply with potential regulations.
  - Advocate for sustainable practices within local agri-business communities.

➢ **Pest and Disease Outbreaks**:

- Risk: - Can spread quickly and affect entire regions, impacting supply chains.
- **Mitigation Strategies:**
  - Adoption of integrated pest management (IPM) strategies and timely monitoring of crops to detect early signs of disease.

9.3.3. Firm Level Risks

- **Operational Risks**: Equipment failures in irrigation systems leading to crop stress or failure.
- **Market Fluctuations**: Changes in demand can result in overproduction or underproduction.

Mitigation Strategies:

- Regular maintenance and upgrading of irrigation equipment to reduce downtime.
- Utilizing market analytics to make informed planting and harvesting decisions based on demand trends.

- **Drought and Water Shortages**

- **Risk**: Insufficient water availability can lead to reduced yields.
- **Mitigation**:
    - Implement drip irrigation systems to conserve water.
    - Utilize rainwater harvesting systems to supplement water supply.
    - Use drought-resistant plant varieties.

- **Flooding and Waterlogging**

- **Risk**: Excess water can lead to root rot and reduced crop health.
- **Mitigation**:
    - Use raised beds or ridges for planting to enhance drainage.
    - Design effective drainage systems to manage excess water.
    - Monitor weather forecasts to adjust irrigation schedules accordingly.

- **Soil Erosion**

- **Risk**: Water movement can erode soil, especially in sloped terrains.
- **Mitigation**:
    - Implement cover cropping and mulching to protect soil.
    - Use contour farming methods to reduce runoff.
    - Establish buffer zones with vegetation to slow water flow.

- **Pests and Diseases**

- **Risk**: Over-irrigation can create habitats for pests and diseases.
- **Mitigation**:
    - Utilize integrated pest management (IPM) practices.
    - Regularly monitor crops for early signs of pests or diseases.
    - Promote healthy soil and plant resilience through proper fertilization.

By understanding the strengths, weaknesses, opportunities, and threats related to irrigation and proactively addressing the risks associated with vegetable and fruit production, farmers can enhance productivity, sustainability, and profitability.

Effective management of irrigation in vegetable and fruit production offers numerous benefits, but it also comes with risks at various levels. By implementing targeted mitigation strategies, farmers can enhance sustainability, resilience, and profitability in their operations while adapting to changing environmental and market conditions. Comprehensive planning and proactive management are crucial for success in this sector.

10. SWOT Analysis

10.1. Strengths

- **Enhanced Crop Yields**: Efficient irrigation systems that mainly focused on drip and surface irrigation is used that also increase the productivity of vegetables and fruits.
- **Water Control**: effective water control will be implemented on the project area as two water source named as Thore Rivers as well as Bore hole water source as well as Pond water collected from natural rain as well as collected from the source water are used that Provides better management of water resources, optimizing their use.
- **Reduced Dependency on Rainfall**: Irrigation can secure crop growth in arid regions or during dry spells.
- **Improved Quality of Produce**: Consistent watering results in better quality fruits and vegetables.
- **Facilitates Year-Round Production**: Irrigated fields allow for off-season growing and diversification of crops.

10.2. Weaknesses

- **High Initial Costs**: Investment in irrigation infrastructure can be significant.
- **Maintenance Requirements**: Irrigation systems require regular upkeep, which can be resource-intensive.
- **Waterlogging and Soil Salinization**: Improper management can lead to negative soil health issues.
- **Dependency on Energy**: Some irrigation systems (e.g., pumps) depend on energy availability.

10.3. Opportunities

- **Technological Advancements**: Smart irrigation technologies (like drip systems) can optimize water use
- **Government Support and Subsidies**: Potential funding from governments for water resource management and sustainable practices.
- **Growing Demand for Organic Produce**: Irrigated conditions can support organic vegetable and fruit farming.

- **Climate Change Adaptation**: Improved irrigation practices can mitigate drought effects caused by climate change.

10.4. Threats

- **Water Scarcity**: Over-extraction of water can threaten water availability for agriculture.
- **Regulatory Challenges**: Changes in water management laws or restrictions can impact irrigation practices.
- **Climate Change**: Extremes in weather patterns, such as floods or droughts, can affect irrigation systems' effectiveness.
- **Soil Degradation**: Continuous irrigation without proper management can lead to soil erosion or nutrient depletion.

11. Conclusion and Recommendation

The project consumes some of the area's abundant resources (land, labor and water) in a way that will maximize the economic contribution of those assets to local residents. When evaluated in terms of the project impacts on scion-economic, physical environment and biological environments, the positive impact of the project are long lasting and have multiplicative characteristics while most of the undesirable impacts are likely short term in nature and can be easily mitigated by proper implementations and timely monitoring of the recommended environmental management plans. The strategic objective of the project is highly consistent with the national development objective which calls to "sustainably increase rural incomes and national food security", which embodies the concepts of producing more, selling more, nurturing the environment, eliminating hunger and protecting the vulnerable against shocks. Furthermore, this project is expected to create job opportunities for these potential migrants at their nearby village and hence alleviate the pushing factor for migrations. Moreover, the project aims at utilizing locally available technologies so as to encourage the backward and forwarded linkage of the project and hence contribute towards the realization of Agricultural Development Led Industrialization (ADLI) strategy of the country. The project will largely contribute towards the national economic development by contributing to National GDP. From financial perspective, the project is very impressive when measured in terms of all forecasted financial statements as well as such ratios as NPV, BCR, NBCR, IRR and ROI.

Recommendation: - considering the viability of project, as aforementioned, the project is recommended for implementation.

Annex-1:- Assumptions and the Related Data

Repair & maintenance
2% of original cost for building
5% of original cost for machinery & equipment
2% of original cost for furniture and fixture
10% of original cost for vehicle
Depreciation and amortization
5% of original cost for building
10% of original cost for machinery and equipment
10% of original cost for furniture % Fixture
20% of original cost for Vehicle
Other Expense
Insurance 0.75% for fixed asset

Table 13:-Labor Requirement per Hectares of each Vegetable

Crop Types	Total Hectares	Operation	1	2	3	4	5	6	7	8	9	10
Vegetable	40	Land Clearing & Preparation	60	60	60	60	60	60	60	60	60	60
		Planting	75	75	75	75	75	75	75	75	75	75
		Cultivation/Weeding	60	60	60	60	60	60	60	60	60	60
		Chemical application	10	10	10	10	10	10	10	10	10	10
		Fruit Collection/Harvesting	80	80	80	80	80	80	80	80	80	80
		Threshing and Packing	45	45	45	45	45	45	45	45	45	45
		Total	330	330	330	330	330	330	330	330	330	330
Friut	185	Land Clearing & Preparation	175	175	175	175	175	175	175	175	175	175
		Planting	220	220	220	220	220	220	220	220	220	220
		Cultivation/Weeding	175	175	175	175	175	175	175	175	175	175
		Chemical application	20	20	20	20	20	20	20	20	20	20
		Fruit Collection/Harvesting	225	225	225	225	225	225	225	225	225	225
		Threshing and Packing	65	65	65	65	65	65	65	65	65	65
		Total	880	880	880	880	880	880	880	880	880	880
	225	Total Labor Requirement	1210	1210	1210	1210	1210	1210	1210	1210	1210	1210

1. Land Clearing: This typically requires a significant amount of labor, especially for the initial preparation of land. It is estimated to be range from 2 to 5 laborers per hectare depending on the density of vegetation and the tools used.
2. Planting: estimate around 3 to 10 laborers per hectare.
3. Weeding: Estimates often range from 2 to 5 laborers per hectare throughout the growing season.
4. Chemical Application: estimated at around 1 to 3 laborers per hectare.
5. Harvesting and Threshing/Packing: an estimate might be 5 to 10 laborers per hectare.

Source:- FAO (Food and Agriculture Organization): Provides manuals and reports on the labor requirements for various crops, Ethiopian Agricultural Research Institute (EARI): Local studies and reports may offer region-specific labor estimates and World Bank Reports: May provide insights into agricultural labor estimates in developing nations like Ethiopia.

Table 14:-Labor Cost											
Years		1	2	3	4	5	6	7	8	9	10
Vegetable	Labor per Ha	330	330	330	330	330	330	330	330	330	330
	Land area	40	40	40	40	40	40	40	40	40	40
	Sub Total	13,200	13200	13200	13200	13200	13200	13200	13200	13200	13200
Fruit	Labor Per Ha	880	880	880	880	880	880	880	880	880	880
	Land area	185	185	185	185	185	185	185	185	185	185
	sub Total	162,800	162800	162800	162800	162800	162800	162800	162800	162800	162800
Total Annual labor Requirement		176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000
Labor Cost Per Work-day (Birr)		350	350	350	350	350	350	350	350	350	350
Project Wage Cost per year		61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000

	Fruit and Vegetables	225						
		unit	Amount Required		Cost (Birr)			
	Fertilizer		Per Ha	Total	per Unit	Total		
1	DAP (K2, P4 & S)	Quintal	7	1575	4500	7,087,500		
2	UREA (N2)	Quintal	8	1800	4500	8,100,000		
3	Pesticides (Agro-set)	L	4	900	4500	4,050,000		
4	Insecticides	L	4	900	4500	4,050,000		
5	Seedling & Nursery Fruit preparation	No	17709	17709	1200	21,250,400		
6	Input Transportation	Kg	10000	10000	120	1,200,000		
7	Output Transportation	Kg	10000	10000	120	1,200,000		
8	Sacking Materials	Pcs	10000	10000	60	600,000		
	Sub-Total					47,537,900		
	Total Estimated Input costs					47,537,900		
	Tractor related Annual fuel costs per year							
	Fruit and Vegetables	85						
		unit	Requirement		Fuel Consumption		Fuel Price	
	Description		Per Ha	Total	Per hour/L	Total	per Liter/Birr	Total
	Tractor Operation	T/H	2	1				
1	Ploughing	T/H	2	500	98	49000	115	5635000
2	Discing & Harrowing	T/H	2	500	98	49000	115	5635000
	Sub-Total							11,270,000
	Total supplies Costs							**58,807,900**

Table 21: Periodic Annual sales revenues from each crop (at the Farm gate price in birr)											
Crops	Year (G.C)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Vegetable	Price (Birr)	1,750	1,838	1,929	2,026	2,127	2,233	2,345	2,462	2,586	2,715
	Production	10,000	10,500	11,025	11,576	12,155	12,155	12,155	12,155	12,155	12,155
	Sales (Birr)	17,500,000	19,293,750	21,271,359	23,451,674	25,855,470	27,148,244	28,505,656	29,930,939	31,427,486	32,998,860
Fruit	Price (Birr)			3,200	3,360	3,528	3,704	3,890	4,084	4,288	4,288
	Production (quintal)	0	0	64,750	106,357	117,258	129,277	142,528	157,137	173,244	191,002
	Sales (Birr)	0	0	207,200,000	357,358,838	413,687,524	478,895,020	554,380,848	641,765,129	742,923,357	819,073,002
Total Sales Revenues		17,500,000	19,293,750	228,471,359	380,810,511	439,542,995	506,043,264	582,886,504	671,696,068	774,350,843	852,071,862
Note That:- Sales Revenue is taken starting from the third year as most of the fruit yields at that age											

Table 20:-Total Operating Costs & Working Capital (Birr)										
Year	1	2	3	4	5	6	7	8	9	10
Employments Salaries	6976800	7325640	7325640	7325640	7325640	7325640	7325640	7325640	7325640	7325640
Pension Contributions	767,448	805,820	846,111	888,417	932,838	979,480	1,028,454	1,079,876	1,133,870	1,190,564
Land Lease (Birr 155.4)	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930
Labor Cost/Wage Cost	61,600,000	61600000	61600000	61600000	61600000	61600000	61600000	61600000	61600000	61600000
Repairs & Maintenance	5,109,348	5,109,348	5109348	5109348	5109348	5109348	5109348	5109348	5109348	5109348
Utilities Cost	680000	714000	714000	714000	714000	714000	714000	714000	714000	714000
Supplies Cost	58,807,900	61748295	61748295	61748295	61748295	61748295	61748295	61748295	61748295	61748295
Insurance Expense	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558
Miscellaneous Cost	585,000	614250	614250	614250	614250	614250	614250	614250	614250	614250
Total Operating	134,820,984	138,211,842	138,252,133	138,294,438	138,338,859	138,385,501	138,434,475	138,485,898	138,539,892	138,596,585

Table 22: Estimation of Annual Depreciation expenses										
Years (G.C)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Construction	2,464,250	2,464,250	2,464,250	2,464,250	2,464,250	2,464,250	2,464,250	2,464,250	2,464,250	2,464,250
Vehicle	5,960,000	5,960,000	5,960,000	5,960,000	5,960,000	5,960,000	5,960,000	5,960,000	5,960,000	5,960,000
Machineries & Equipment	2,244,293	2,244,293	2,244,293	2,244,293	2,244,293	2,244,293	2,244,293	2,244,293	2,244,293	2,244,293
Furniture & Fixture	107,510	107,510	107,510	107,510	107,510	107,510	107,510	107,510	107,510	107,510
Land Development (amortized)	295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000
Total	11,071,053	11,071,053	11,071,053	11,071,053	11,071,053	11,071,053	11,071,053	11,071,053	11,071,053	11,071,053
Acc.Dep.Const	2,464,250	4,928,499	7,392,749	9,856,999	12,321,248	14,785,498	17,249,747	19,713,997	22,178,247	24,642,496
Acc.Dep.Vehicle	478,000	956,000	1,434,000	1,912,000	2,390,000	2,868,000	3,346,000	3,824,000	4,302,000	4,780,000
Acc.Dep.Machine	245,500	491,000	736,500	982,000	1,227,500	1,473,000	1,718,500	1,964,000	2,209,500	2,455,000
Acc.Dep.Furn	7,550	15,100	22,650	30,200	37,750	45,300	52,850	60,400	67,950	75,500
Acc.Dep.Amor	295,000	590,000	885,000	1,180,000	1,475,000	1,770,000	2,065,000	2,360,000	2,655,000	2,950,000

Table 23: Projected Periodical Loan repayment and Interest Expense										
Year (G.C)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Principal Loan Outstanding	180,280,507	162,252,456	144,224,405	126,196,355	108,168,304	90,140,253	72,112,203	54,084,152	36,056,101	18,028,051
Periodic Loan Repayment	18,028,051	18,028,051	18,028,051	18,028,051	18,028,051	18,028,051	18,028,051	18,028,051	18,028,051	18,028,051
Outstanding Loan at the end	162,252,456	144,224,405	126,196,355	108,168,304	90,140,253	72,112,203	54,084,152	36,056,101	18,028,051	0
Periodic Interest Expense	22,535,063	20,281,557	18,028,051	15,774,544	13,521,038	11,267,532	9,014,025	6,760,519	4,507,013	2,253,506
Total Periodical Payment	40,563,114	38,309,608	36,056,101	33,802,595	31,549,089	29,295,582	27,042,076	24,788,570	22,535,063	20,281,557
Note That:- the Loan Re-payment will assumed to be started at the Third year as the friut prodcution year is at that time										

Table 24:- Insurance Expense Per Year

Ser. No.	Description	Value (Birr)	Insurance Rate (%)	Insurance Cost
1	Building and Construction	49,284,993	0.20%	98,570
2	Machinery and Equipment	22,442,932	0.20%	44,886
3	Vehicle	29,800,000	0.20%	59,600
4	Office Furniture and Equipment	1,075,100	2.00%	21,502
Total		102,603,025		224,558

Table 25: Projected Annual Income Statement (all in Birr)										
Years (G.C)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Total Revenues (Table 21)	17,500,000	19,293,750	228,471,359	380,810,511	439,542,995	506,043,264	582,886,504	671,696,068	774,350,843	852,071,862
Operating Expense										
Salaries Expense	6,976,800	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640
Pension Contribution	767,448	805,820	846,111	888,417	932,838	979,480	1,028,454	1,079,876	1,133,870	1,190,564
Land Lease (birr 155.4/HA)	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930
Wages Expense	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000
Repair & Maintenance	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348
Utilities Expense	680,000	714,000	714,000	714,000	714,000	714,000	714,000	714,000	714,000	714,000
Supplies Expense	58,807,900	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295
Insurance Expense	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558
Miscellenous Expense	585,000	614,250	614,250	614,250	614,250	614,250	614,250	614,250	614,250	614,250
Total Operating Expense	134,820,984	138,211,842	138,252,133	138,294,438	138,338,859	138,385,501	138,434,475	138,485,898	138,539,892	138,596,585
Income Before Income Tax	-117,320,984	-118,918,092	90,219,227	242,516,073	301,204,135	367,657,763	444,452,029	533,210,170	635,810,952	713,475,277
Income Tax (30%)	(35,196,295)	(35,675,428)	27,065,768	72,754,822	90,361,241	110,297,329	133,335,609	159,963,051	190,743,285	214,042,583
Net Income	**(82,124,689)**	**(83,242,664)**	**63,153,459**	**169,761,251**	**210,842,895**	**257,360,434**	**311,116,420**	**373,247,119**	**445,067,666**	**499,432,694**
Retained Earnings	46,423,561	(36,819,103)	63,153,459	232,914,710	443,757,604	701,118,039	1,012,234,459	1,385,481,578	1,830,549,244	2,329,981,937
Note That:- The Income becomes lower at the first and second year as the fruit production will be started at the third year										

Table 26: Projected Annual Cash flow Statement (all in Birr)										
Years (G.C)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
1. Cash flow of Operating activities										
Cash Inflows										
Cash Collections	17,500,000	19,293,750	228,471,359	380,810,511	439,542,995	506,043,264	582,886,504	671,696,068	774,350,843	852,071,862
Cash Outflows										
Salaries payment	6,976,800	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640	7,325,640
Pension Contribution	767,448	805,820	846,111	888,417	932,838	979,480	1,028,454	1,079,876	1,133,870	1,190,564
Land lease (Br 155.4/ha)	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930	69,930
Wages payment	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000	61,600,000
Repair & maintenance	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348	5,109,348
Utilities & Expense	680,000	714,000	714,000	714,000	714,000	714,000	714,000	714,000	714,000	714,000
Supplies Expense	58,807,900	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295	61,748,295
Insurance Expense	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558	224,558
Miscellaneous Expense/Pre-operating Expense	585,000	614,250	644,963	677,211	711,071	746,625	783,956	823,154	864,311	907,527
Interest Payment	22,535,063	20,281,557	18,028,051	15,774,544	13,521,038	11,267,532	9,014,025	6,760,519	4,507,013	2,253,506
Income Tax (30%)	-35,196,295	-35,675,428	27,065,768	72,754,822	90,361,241	110,297,329	133,335,609	159963051	190,743,285	214042583
Total Cash Outflows	122,159,752	122,817,971	183,376,664	226,886,765	242,317,959	260,082,736	280,953,815	305,418,371	334,040,251	355,185,951
Net Cash Provided by operation	(104,659,752.36)	(103,524,221)	45,094,695	153,923,746	197,225,036	245,960,528	301,932,689	366,277,696	440,310,592	496,885,910
Cumulative Net Cash	122,159,752	122,817,971	167,912,667	321,836,413	519,061,448	765,021,976	1,010,982,504	1,256,943,032	1,558,875,720	2,496,072,223

Table 27: Balance Sheet of the Project (all in Birr)										
Years (G.C)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Asset										
Current Asset										
Cumulative Cash	122,159,752	122,817,971	167,912,667	321,836,413	519,061,448	765,021,976	1,010,982,504	1,256,943,032	1,558,875,720	2,496,072,223
Recivebale amount	221,738,657	-19,841,955	27,971,403	36,744,401	43,297,752	47,633,150	105,724,535	225,946,618	362,017,088	-100,839,279
Total Current Asset	343,898,409	102,976,016	195,884,070	358,580,813	562,359,200	812,655,127	1,116,707,039	1,482,889,650	1,920,892,808	2,395,232,943
Fixed Asset										
Construction Cost	49,284,993	49,284,993	49,284,993	49,284,993	49,284,993	49,284,993	49,284,993	49,284,993	49,284,993	49,284,993
Accumulated Dep. Construction	-2,464,250	-4,928,499	-7,392,749	-9,856,999	-12,321,248	-14,785,498	-17,249,747	-19,713,997	-22,178,247	-24,642,496
Vehicles	29,800,000	29,800,000	29,800,000	29,800,000	29,800,000	29,800,000	29,800,000	29,800,000	29,800,000	29,800,000
Accumulated Dep. Vehicles	-5,960,000	-11,920,000	-17,880,000	-23,840,000	-29,800,000	-35,760,000	-41,720,000	-47,680,000	-53,640,000	-59,600,000
Machineries & Equip	22,442,932	22,442,932	22,442,932	22,442,932	22,442,932	22,442,932	22,442,932	22,442,932	22,442,932	22,442,932
Acc.Dep. Mach & Equip.	-2,244,293	-4,488,586	-6,732,880	-8,977,173	-11,221,466	-13,465,759	-15,710,052	-17,954,346	-20,198,639	-22,442,932
Land Development Cost	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000	2,950,000
Acc.Dep.Amortization	-295,000	-590,000	-885,000	-1,180,000	-1,475,000	-1,770,000	-2,065,000	-2,360,000	-2,655,000	-2,950,000
Total Fixed Assest	93,514,382	82,550,839	71,587,296	60,623,753	49,660,211	38,696,668	27,733,125	16,769,582	5,806,039	-5,157,504
Total Asset	**437,412,791**	**185,526,855**	**267,471,366**	**419,204,567**	**612,019,411**	**851,351,794**	**1,144,440,164**	**1,499,659,232**	**1,926,698,847**	**2,390,075,440**
Liability										
Bank Loan	180,280,507	162,252,456	144,224,405	126,196,355	108,168,304	90,140,253	72,112,203	54,084,152	36,056,101	0
Capital										
Owner's Equity	60,093,502	60,093,502	60,093,502	60,093,502	60,093,502	60,093,502	60,093,502	60,093,502	60,093,502	60,093,502
Retained Earning	46,423,561	(36,819,103)	63,153,459	232,914,710	443,757,604	701,118,039	1,012,234,459	1,385,481,578	1,830,549,244	2,329,981,937
Total Capital	106,517,063	23,274,399	123,246,961	293,008,212	503,851,107	761,211,541	1,072,327,961	1,445,575,080	1,890,642,746	2,390,075,440
Total Liability + Capital	**286,797,570**	**185,526,855**	**267,471,366**	**419,204,567**	**612,019,411**	**851,351,794**	**1,144,440,164**	**1,499,659,232**	**1,926,698,847**	**2,390,075,440**

Table 29: Implementation Plan of the Project

Sr. No.	Type of Activities	2025	2025/26					
		February	March	April	May	June	July	August
1	Loan processing							
2	Completion of building & Irrigation construction works							
3	Purchasing of Irrigation materials needed							
4	Importing Machinery and Equipment							
5	Procurement of vehicle							
6	Installation of electric power							
7	Procurement of generator							
8	Procurement of office furniture & equipment							
9	Recruitment of employees							
10	Land clearing (2x)							
11	Commencement of Operation of irrigation land plough and all other properties							

Annex- 2:- The Cost of Seedling and Estimated Asset Values for Fruit Crops in Ethiopia

The cost of preparing seedlings for various fruit crops in Ethiopia can vary significantly depending on many factors, including local labor rates, the specific variety of the crops, regional climatic conditions, and soil types. Below is a breakdown of potential costs for preparing seedlings for specific crops like Banana, Lemon, Red Orange, Valencia Orange, Pomegranate, Papaya, Avocado, Watermelon, Cucumber, and Coffee. All figures are estimative and can fluctuate over time.

Accordingly, reference has been taken from the source of seedling cost etimation mentioned below;

Cost Factors Breakdown

Crop	Estimated Cost (USD/Seedling)	Source of Information
Banana	$0.50 - $1.00	Ethiopian Agricultural Research
Lemon	$0.25 - $0.50	Market and Price Information
Red Orange	$0.30 - $0.60	Ethiopian Horticulture Research
Valencia Orange	$0.30 - $0.60	Ethiopian Horticulture Research
Pomegranate	$0.20 - $0.50	Ethiopian Agricultural Research
Papaya	$0.40 - $0.80	Market Price Information
Avocado	$1.00 - $2.00	Ethiopian Horticulture Research
Watermelon	$0.10 - $0.20	Amhara Agricultural Research Institute
Cucumber	$0.05 - $0.15	Amhara Agricultural Research Institute
Coffee	$0.50 - $1.00	Ethiopian Coffee and Tea Authority

Crop	Estimated Seedling Cost (USD)	Seedlings per Hectare
Banana	$0.50 - $1.00 per seedling	1,200 - 1,800
Lemon	$0.25 - $0.50 per seedling	1,000 - 1,200
Red Orange	$0.30 - $0.60 per seedling	800 - 1,000
Valencia Orange	$0.30 - $0.60 per seedling	800 - 1,000
Pomegranate	$0.20 - $0.50 per seedling	800 - 1,000
Papaya	$0.40 - $0.80 per seedling	1,000
Avocado	$1.00 - $2.00 per seedling	400 – 500
Watermelon	$0.10 - $0.20 per seedling	5,000 - 6,000
Cucumber	$0.05 - $0.15 per seedling	10,000 - 14,000
Coffee	$0.50 - $1.00 per seedling	1,000 - 1,600

Cost Components

- **Soil Preparation:** $100 - $300 per hectare
- **Irrigation Setup:** $200 - $500 (depends on the irrigation method)
- **Labor Costs:** $150 - $350 (for planting and maintaining seedlings)
- **Fertilizer and Pesticides:** $100 - $300

Estimated Total Seedling Costs per Hectare

Here's an estimated range of costs for preparing seedlings:

Crop	Seedlings / Hectare	Soil Prep	Irrigation	Labor	Fertilizer/Pesticides	Total Estimated Cost (Average)
Banana	1,200 - 1,800	$150	$300	$250	$150	$850
Lemon	1,000 - 1,200	$150	$300	$250	$150	$850
Red Orange	800 - 1,000	$150	$300	$200	$100	$725
Papaya	1,000	$150	$300	$200	$150	$800
Avocado	400 – 500	$150	$300	$200	$100	$725

The existing plantation and its asset value

Estimated Asset Values for Fruit Crops in Ethiopia

Crop	Estimated Yield (Ton/Ha)	Estimated Market Price (USD/Ton)	Estimated Production Cost (USD/Ha)	Net Returns (USD/Ha)	Sources for Citation
Banana	25 – 35	$200 - $400	$2,000 - $2,500	$1,500 - $9,000	[1], [2]
Lemon	10-15	$300 - $600	$1,000 - $1,500	$2,000 - $7,500	[1], [3]
Red Orange	10-15	$300 - $600	$1,200 - $1,800	$800 - $6,000	[1], [3]
Valencia Orange	10-15	$300 - $600	$1,200 - $1,800	$800 - $6,000	[1], [3]
Pomegranate	7-10	$400 - $800	$1,000 - $1,500	$2,800 - $6,500	[1], [4]
Papaya	10-15	$300 - $700	$1,000 - $1,500	$3,000 - $8,500	[1], [5]
Avocado	5-10	$1,000 - $1,500	$1,200 - $2,000	$3,000 - $8,000	[1], [5]
Watermelon	20 – 30	$200 - $400	$800 - $1,200	$2,000 - $7,500	[1], [6]
Cucumber	15 – 20	$300 - $500	$800 - $1,200	$2,000 - $7,000	[1], [6]
Coffee	1-2	$2,000 - $3,000	$1,500 - $2,000	$500 - $4,500	[1], [7]

Notes:

- **Estimated Yield**: These values represent average yields per hectare. Actual yields can vary based on agronomic practices, region, and climatic conditions.
- **Estimated Market Price**: Price can vary widely based on supply conditions, demand, and market access. The prices provided are estimated based on market conditions and previous data.
- **Estimated Production Cost**: Costs can include labor, inputs (fertilizers, pesticides), irrigation, and other operational costs.
- **Net Returns**: This column provides an estimate of the potential profit, calculated as market revenue minus production costs.

Asset Values for 2-Year-Old Fruit Plants in Ethiopia

Crop	Estimated Market Price (USD)	Expected Yield (tons/hectare/year)	Production Cost (USD/hectare)	Estimated Asset Value (USD)	Source for Citation
Banana	$1.00 - $2.00 per kg	25 - 30 tons	$2,000 - $3,000	$25,000 - $60,000	[1], [2]
Lemon	$0.50 - $1.00 per kg	10 - 15 tons	$1,500 - $2,500	$5,000 - $15,000	[1], [3]
Red Orange	$0.40 - $0.80 per kg	10 - 15 tons	$1,500 - $2,500	$4,000 - $12,000	[1], [3]
Valencia Orange	$0.40 - $0.80 per kg	10 - 15 tons	$1,500 - $2,500	$4,000 - $12,000	[1], [3]
Pomegranate	$0.50 - $1.00 per kg	8 - 12 tons	$1,500 - $2,500	$4,000 - $12,000	[1], [4]
Papaya	$0.30 - $0.60 per kg	20 - 25 tons	$1,000 - $1,500	$6,000 - $15,000	[1], [5]
Avocado	$1.00 - $3.00 per kg	5 - 10 tons	$1,500 - $2,500	$5,000 - $30,000	[1], [5]
Watermelon	$0.20 - $0.40 per kg	30 - 40 tons	$800 - $1,200	$6,000 - $16,000	[1], [6]
Cucumber	$0.10 - $0.20 per kg	20 - 30 tons	$500 - $1,000	$2,500 - $6,000	[1], [6]
Coffee	$2.00 - $3.00 per kg	3 - 5 tons	$1,500 - $2,000	$6,000 - $15,000	[1], [7]

Sources for Citation:

1. Ethiopian Agricultural Research Organizations - Annual reports and market analysis on fruit crops.
2. Food and Agriculture Organization (FAO) - Provides research and market data on agricultural production in Ethiopia.
3. Ministry of Agriculture and Rural Development, Ethiopia - Agricultural statistics and market price analysis.
4. The World Bank - Reports on agricultural value chains, including fruits in Ethiopia.
5. Ethiopian Horticultural Development Association (EHDA) - Publications detailing production and marketing of horticultural crops.
6. Local agricultural offices, universities, and research institutions - For more precise and updated financial and yield data.

Hint: - Valuing agricultural assets, such as tree fruits, involves considering several factors, including the type of fruit, the age of the trees, the expected yield, market prices, and production costs. Since you mentioned two-year-old trees for various fruits, I will provide a general overview for each fruit you listed, keeping in mind that specific valuations can vary based on local market conditions, care practices, and environmental factors.

General Considerations for Asset Valuation:

1. **Market Price**: Research current market prices for each fruit. Prices can fluctuate based on seasonality, demand, and supply.
2. **Yield Estimates**: Determine the expected yield for each type of fruit from two-year-old trees. Some tree fruits may not yield fruit until they are older.
3. **Production Costs**: Include costs associated with cultivation, including soil preparation, planting, irrigation, fertilizers, pest control, labor, and maintenance.
4. **Additional Factors**: Consider the location, quality of soil, water availability, and climate conditions, which can significantly affect yield and quality. Additionally, any potential marketing or transportation costs should be factored in.

Fruit Valuation Overview:

1. **Banana**:
    - Yield: Generally starts producing fruit in 9-12 months.
    - Valuation: Consider production costs (fertilizers, labor) and current market price per bunch.
2. **Lemon**:
    - Yield: Usually starts producing fruit by the end of the second year but minimal yield.
    - Valuation: Check current prices for lemons and estimate production costs. Lemons generally have a steady market.
3. **Red Orange**:
    - Yield: Typically can start yielding in 2-4 years.
    - Valuation: Check specific prices of red oranges in your area. Costs will include planting, maintenance, and harvest.
4. **Valencia Orange**:
    - Yield: Usually starts bearing fruit in the third year.
    - Valuation: Consider the cost of care and current market price for Valencia oranges.
5. **Pomegranate**:
    - Yield: May yield a small amount at two years.
    - Valuation: Check market prices; pomegranates often have good market demand but costs can include pruning and pest management.
6. **Papaya**:

- Yield: Can produce fruit in 6-12 months.
- Valuation: Assess production costs and market price as papayas often have a higher turnover rate.

7. **Avocado**:
   - Yield: Generally starts producing in 3-4 years, so little to no yield at two years.
   - Valuation: Although they may not have yield yet, assess market potential and maintenance costs.
8. **Watermelon**:
   - Yield: Usually treated as an annual crop rather than a tree fruit; can yield in a few months.
   - Valuation: Market fluctuations can be significant; costs need to be calculated based on seasonal production.
9. **Cucumber**:
   - Yield: Again, treated as annual; can yield in as little as 6-8 weeks.
   - Valuation: Similar to watermelon, focus on seasonal market prices and costs.
10. **Coffee**:
    - Yield: Can begin producing at 3-4 years, little yield at two years.
    - Valuation: Evaluate current coffee prices and cost of care.