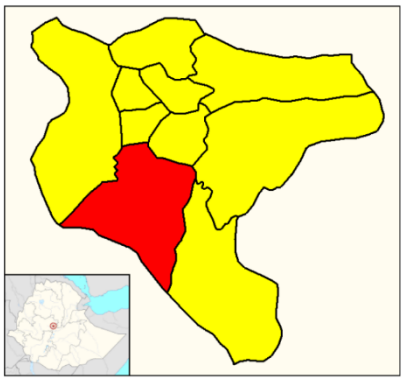
Feasibility study for the production of compost from organic municipal waste in Addis Ababa

The Case of Nefas Silk Lafto Sub-City



Addis Abeba

January 2024

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MINISTRY OF AGRICULTURE

econvalue CONSULT

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Addis Abeba

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1 Summary

This feasibility study is prepared for a compost project using bio-degradable waste for a location in Nefas silk Lafto Sub city commonly called “Kosehe”. Compost is a partially decomposed organic material used in agriculture to improve soil and enhance plant growth. Compost improves the movement of water, dissolved nutrients, and oxygen through the soil, making it easier for plant roots to absorb these vital substances.

The demand for the demand for compost in and the surrounding areas of Addis Ababa is projected to grow from 126,000 tons in 2024 to 198,263 tons by the year 2028. Moreover, the demand for compost in and the surrounding areas of Addis Ababa is forecasted to reach 438,297 tons by the year 2035. Based on the availability of feedstock and other technical and economic factors, the annual production capacity is set at 4,780 tons of compost.

It is assumed that the required sorted organic waste will be provided by the city administration free of cost. Hence, the only input cost is bio compost facilitator and final products packing material (PP bags). The other major cost is fuel that is used in the composting processes and for transporting waste to the composting facility and final products to end users.

The total annual cost of materials and inputs, at full capacity operation is estimated at Birr 3,498,565 (bio compost facilitator Birr 1,529,524, packing material Birr 788,700 and diesel fuel Birr 1,180,341).

At the land fill site commonly called as *Koshe*, located in Nefas Silk Lafto sub city, 168 Ton of organic waste is damped per day. The nearby Lafto vegetable and fruits market (disposes 8 Ton of bio mass (leftover of vegetable and fruits) per day. This is about 10% of the average daily vegetable and fruit marketed in the market center.

The utilities required by the envisaged project consist of electricity and water. The annual total utility cost at full capacity of operation is estimated at Birr 848,169.

The total cost of the required machinery and equipment is estimated at Birr 9.38 million. Two medium duty trucks are required, the total cost of which, is estimated at Birr 7 million. The total cost of office furniture and equipment is estimated at Birr 514,000.

It is estimated that the envisaged project requires a total of 15,000 m^2 (1.5 hectares) of land. Assuming that the envisaged project will be located in the outskirt of Addis Ababa, the total land lease cost, for a period of 60 years at a land lease rate of Birr 350 per m^2 is estimated at Birr 5.25 million of which 20% or Birr 1,050,000 will be paid in advance. The remaining Birr 4.20 million will be paid in equal installments within 20 years i.e. Birr 210,000 annually. The total cost of the building and civil work is estimated at Birr 10.25 million.

The envisaged plant requires a total of 43 employees. The total annual cost of labour is estimated at Birr 6.60 million. Specialized training is required for operators with a lump-sum cost estimate of Birr 450,000.

The implementation schedule, which covers the activities starting from the project evaluation and approval up to and including the trial run and commissioning, is estimated to take a total of 12 months. The total cost of implementation is estimated at Birr 2.1 million.

The total investment cost of the project including the initial working capital is estimated at Birr 37.44 million. From the total investment cost the highest share (Birr 28.19 million or 75.30%) is accounted by fixed investment cost followed by pre operation cost (Birr 8.07 million or 21.57%) and initial working capital (Birr 1.17 million or 3.13%).

At a selling price of Birr 500 per quintal, the project is financially viable with an internal rate of return (IRR) of 20.65% and a net present value (NPV) of Birr 7.71 million, discounted at 15%. However, a sensitivity analyses undertaken shows that a decrease of 10% in revenue or a decrease of 10% in selling price i.e. from Birr 500 per quintal to Birr 455 per quintal will reduce the IRR of the project to 15.09%, which is very close to the cutoff rate of 15%. The NPV will also become Birr 124 thousand, which is marginal.

Switching value, which is a value beyond which, the project turns out to be financial unviable or not feasible for selling price is a 12% decline in revenue or a selling price of Birr 446 per quintal. The switching value for operating and investment cost is an increase by 21% and 29%, respectively.

2 Product Description and Application

Composting is the biological decomposition of biodegradable solid waste under controlled predominantly aerobic conditions to a state that is sufficiently stable for nuisance-free storage and handling and is satisfactorily matured for safe use in agriculture. The terms and phrases that collectively differentiate composting from other decomposition processes are: “biological decomposition”, “biodegradable”, “under controlled predominantly aerobic conditions”, “sufficiently stable”, and “matured”. The phrase “biological decomposition” implies that the decomposition is accomplished by living organisms. “Biodegradable” refers to the substrate and it requires that the substance be susceptible to decomposition attack by certain living organisms, e.g., bacteria and fungi. Such substances are organic compounds formed either by living organisms or by way of chemical synthesis (e.g., halogenated hydrocarbons) (Bertoldi, M et al, 1983).

Commercial, synthetic fertilizers provide quick nutrient boosts but can be cost prohibitive, requiring government subsidies in many developing countries. At the same time, concerns are growing over the human health and environmental impacts of excessive fertilizer use. Groundwater pollution and the resulting explosive growth of algae in surface waters from the runoff of water-soluble elements are disruptive to ecosystems and drinking water supplies. Further, after repeated applications and crop harvests, synthetic fertilizer depletes and reduces land to sandy, inert materials.

Compost, on the other hand, releases nutrients and organic matter into the soil over many years, improving quality over the long term. In Bangladesh, the use of compost has resulted in a 30% reduction in the use of chemical fertilizer and a 35% reduction in irrigation required (Rashid, 2011).

From a climate perspective, composting could prevent alternative waste management methods that result in emissions.

3 Market Study and Plant Capacity

3.1 Market Study

3.1.1 Past Supply and Present Demand

Agriculture is the dominant economic sector in Ethiopia and it will dominate the economy for the coming decades. Particularly, the challenge for food security is a top priority of the economy. The challenge is expressed in terms of growth in agricultural productivity which is directly related to, among other factors, with improved application and usage of agricultural inputs like fertilizers. In order to estimate the present demand for compost, which is an organic substitute of chemical fertilizer the actual consumption of fertilizer during the period 2011 – 2020 was collected and analyzed. The total supply of fertilizer, which comprises only import, is shown in Table 3.1.

Table 3.1: Supply of Chemical Fertilizer

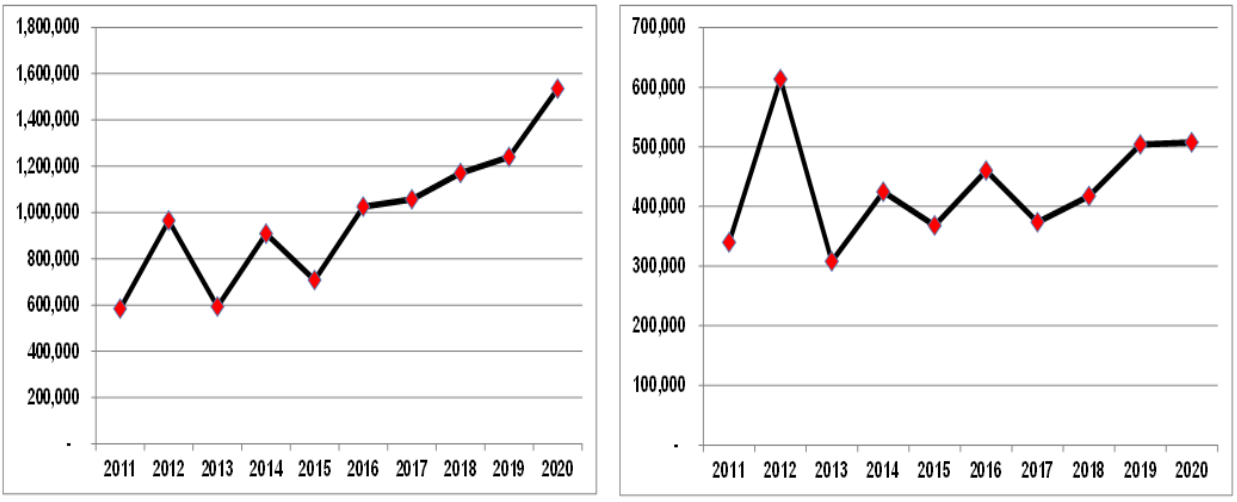
Year	Quantity (Tons)	Values (USD)
2011	583,781	339,676
2012	965,161	613,240
2013	593,388	307,990
2014	908,724	424,736
2015	707,731	368,025
2016	1,025,554	459,960
2017	1,056,920	373,783
2018	1,170,682	417,530
2019	1,240,438	503,769
2020	1,535,045	507,556

Source: *Ethiopian Custom Commission*

As can be seen from Table 3.1, import or total supply of fertilizer has exhibited a substantial growth, nearly tripling with a ten years period, increasing from 583,781 tons in 2011 to 1.53 million ton in 2020, registering an average annual growth rate of 16.25%. The trend in import of fertilizer, in terms of quantity, is graphically shown in Figure 3.1a.

During the same period (2011—2020), on average, the value of imported fertilizer has increased from USD 339.67 million to USD 507.55 million The expenditure for importing fertilizer has registered an average annual growth rate of 10.52%. The trend in import of fertilizer, in terms of value, is graphically shown in Figure 3.1b.

Figure 3.1: Trend in Import or Total Supply of Fertilizer



During the period, 2011-2020, import or total supply of fertilizer has registered an average annual growth rate of 16.25%. Accordingly, assuming that the growth rate registered in the past, will continue, at least in the near future, the present local demand for fertilizer is estimated by taking the 2020 total supply (1,535,045 tons) as a base and in order to be conservative, by applying a growth rate of 10%.

Accordingly, based on the above assumption, the present (year 2023), local demand for fertilizer is estimated at 2,043,145 tons. Assuming that organic fertilizer (compost) share will be only 10% of the total fertilizer demand the current demand for compost is estimated at 204,314 tones. This assumption doesn't argue for a replacement of inorganic fertilizer by compost.

Estimates indicate that over 15,000 hectares of land are cultivated annually in and around Addis Ababa1. Therefore, the potential demand for organic compost could reach 75,000 – 150,000 tons per year, considering generally agreed application rates of compost (5 – 10 tons per hectare). This demand is without taking household-level needs for trees and flowerpots into consideration.

3.1.2 Demand Projection

The demand for fertilizer is directly related with the performance of the end user i.e. the agricultural sector. Ethiopia has long recognized the importance of agricultural sector's transformation for socio economic development of the country. Accordingly, transforming the agricultural sector has been the priority of successive national and sectoral development strategies of the government and due to the considerable and continued investments by the government and emphasis on increasing agricultural production and productivity through utilization of modern inputs such as fertilizer the sector has demonstrated an impressive growth in the past few years.

Agriculture is one of the best prospect sectors for growth in Ethiopia. Recently, the Government of Ethiopia (GOE) has embarked on a ten-year economic development plan (2021-2030) where

[1] *Addis Ababa city = 5,886 hectares; source: Addis Ababa City Administration Report May 2022 and surrounding cities (Burayu, Gelan, Lege Tafo, Sebeta, Suluta = 9,442 hectares; source: Oromia BoA, May 2022*

agriculture is on the top of priority sectors. The agriculture sector is projected to grow at 6.2 percent per annum over the next ten years. Ethiopia's development plan has laid out enhancing agricultural production and productivity as one of the major strategic pillars. In addition, the ten-year development plan aims at boosting agricultural export revenues and substituting imports by reducing production costs. To achieve this, the GOE seeks to leverage on developing huge unutilized arable land, modernizing production systems, and improving uptake of technology. Furthermore, the ten-year plan envisages building a climate resilient green economy. In this regard, Ethiopia pursues to expand development efforts to fight land degradation and to reduce pollution; reduce Green House Gas (GHG) emissions; increase forest protection and development; increase production of electricity from renewable sources for domestic use and for export; and focus on modern and energy saving technologies.

Accordingly, to build on the past successes, create the environment in which the agriculture sector is able to flourish, and unlock many of the systemic obstacles that have limited growth, recently, with the support of the IMF, the Ethiopian government has developed an ambitious Homegrown Economic Reform Plan to propel the country's economic progress. The Homegrown economic reform plan identified structural and institutional bottlenecks affecting the agricultural sector in Ethiopia. The major binding constraints of the sector are insufficient yields due to inefficient provision of inputs and services, unclear land lease rights, limited investment on R&D and irrigation, marketing and logistics related problems, and lack of agriculture-specific financial services. The economic plan prescribes the many comprehensive measures to overcome the challenges facing the agricultural sector including, enhancing the productivity of small-holder farmers and pastoralists through provision of modern inputs and services. Therefore, it can be concluded that due to the continuous commitment of the government to the growth of the agricultural sector, the past growth in the demand for fertilizer will also continue in the future.

Accordingly, considering the trend in the above demand derivers and in order to be conservative a growth rate of 12% is employed to forecast the demand for compost in and the surrounding areas of Addis Ababa.

Based on the above assumptions and using the estimated present demand as a base the projected local demand for fertilizer is shown in Table 3.2.

Table 3.2: Projected Demand for Compost

(in and the Surrounding Areas of Addis Ababa (in Tons)

Year	Projected Demand
2024	126,000
2025	141,120
2026	158,054
2027	177,021
2028	198,263
2029	222,055
2030	248,702
2031	278,546
2032	311,971
2033	349,408
2034	391,337
2035	438,297

As depicted in Table 3.2, the demand for the demand for compost in and the surrounding areas of Addis Ababa is projected to grow from 126,000 tons in 2024 to 198,263 tons by the year 2028. Moreover, the demand for compost in and the surrounding areas of Addis Ababa is forecasted to reach 438,297 tons by the year 2035. *As a note to this, for example, the Addis Abeba Bureau of Urban Beautification and Green Development allocated a budget of 1.5 Bn Birr in 2016 EC of which about 60% is allocated for green area and river basin development.*

3.1.3 Pricing

Based on the current price chemical fertilizer and considering the required inducement for end users to utilize compost produced from waste a price of Birr 500 per quintal is adopted.

3.2 Plant Capacity and Production Programme

3.2.1 Plant Capacity

Based on the availability of feedstock and other technical and economic factors per batch processing capacity of 500 tons of organic waste is selected for the envisaged project. Assuming manual operation, the compost digestion period is 3 to 4 months with intensive labor turning. However, if a bio compost facilitator is used, the compost digestion period will be shortened to 21 days.

Accordingly, assuming that a semi mechanical operation and bio compost facilitator will be used the compost digestion period is assumed to be 21 days. Hence, given the 365 days per annum, compost digestion period of 21 days and per batch processing capacity of 500 tons of organic waste, the annual organic waste processing capacity is set at 8,690 tons.

The final compost produced from sorted municipal organic waste depends on the quality of the organic waste. However, on average the compost yield ranges from 50 to 60% of the organic waste.

Therefore, considering the waste is reduced by 45% during the compost process (a compost yield of 55%), the annual production capacity is set at 4,780 tons of compost.

3.2.2 Production Programme

Considering the time needed for production skill development and market penetration, production is intended to start at 60% of capacity during the initial period. Production will then rise to 80% and 100% in the second and third year, respectively. Production build-up program is shown in Table 3.3.

Table 3.3 : Production Programme

Year	1	2	3 and above
Capacity utilization (%)	60	80	100
Production (tons)	2,868	3,824	4,780

4 Materials and Inputs

4.1 Raw Materials

4.1.1 Availability of Feedstock

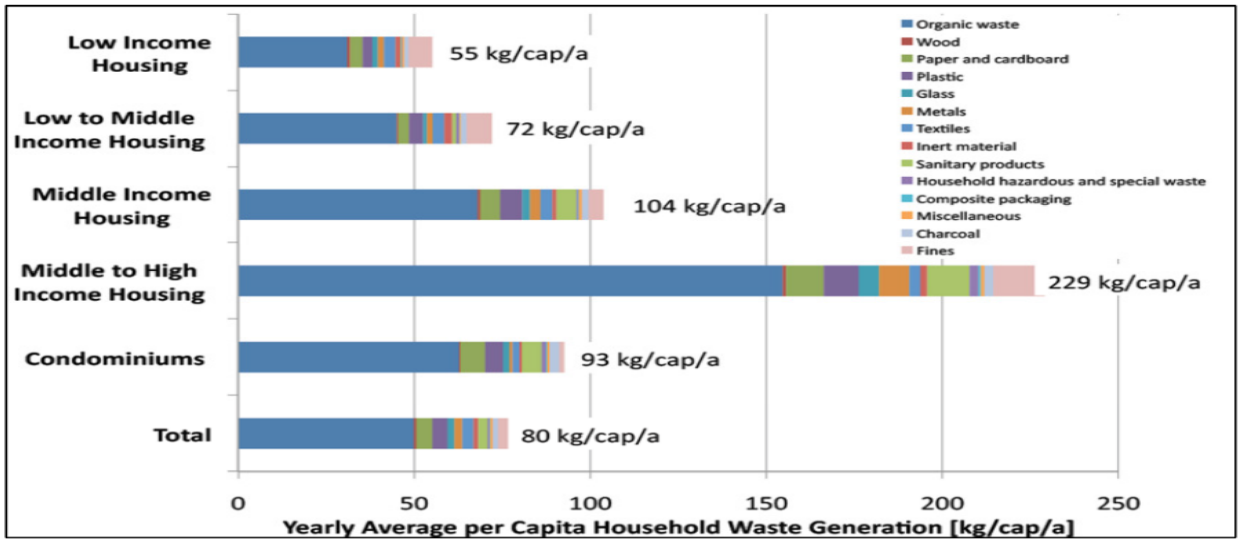
Municipal solid waste" (MSW) is a term usually applied to a heterogeneous collection of wastes produced in urban areas, the nature of which varies from region to region. Municipal solid waste in developing countries is well suited for composting given that it is mostly comprised of organic matter.

In Ethiopia like developing countries, increase in solid waste generation has resulted from rapid urbanization and population growth. As of 2010 the average solid waste generation rate was estimated at about 0.221 kg per person per day (Zebenay, 2010). Nevertheless, according to a report by Ministry of Urban Development, Housing and Construction (MUDHCo) "State of Ethiopian Cities", June 2015, the current level of solid waste generation in Ethiopia is estimated at 0.4 kg per day. The per capita solid waste generation rate seems to be growing towards the developing countries' level of 0.4 - 0.9 kg/person per day (IGNIS, 2010). According to a study undertaken by IGNIS (Income Generation and Climate Protection by Valorizing Municipal Solid Waste in a Sustainable Way in Emerging Mega Cities), the annual per capita waste generated in Addis Ababa ranges from 229 kg for middle to high income areas to 55 kg for low income areas, with an average 80 kg per capita (see Figure 4.1). At the land fill site commonly called as *Koshe*, located in Nefas Silk Lafto sub city, 168 Ton of organic waste is damped per day. The nearby Lafto vegetable and fruits market (disposes 8 Ton of bio mass (leftover of vegetable and fruits) per day. This is about 10% of the average daily vegetable and fruit marketed in the market center.

Box: Urban greenery in focus

The Addis Abeba Bureau of Beautification and Urban Development budgeted 1.5 Bn Birr for the year 2023/24 to be used for a variety of green initiatives that include river basin and landscape development. This budget considers using different plants and trees and productive soil to change the landscape and nurture the selected sites within the city. This shows the huge potential for compost market within the city for beautification and landscape development in addition to the application for the production of fruits and vegetable.

Figure 4.1: Yearly Per Capita Waste Generation in Addis Ababa by Income Group



Source - *IGNIS Joint Final Report, 2014*

Various studies have also attempted to estimate the per capita solid waste generation rates for other cities/towns. Fikreyesus, D. (2011) has estimated the municipality waste generation rate in Addis Ababa at 1,132 tons per day, while for other municipalities the estimated was below 100 tons/day (see Table 4.1).

Table 4.1 : Ethiopian Municipalities and Waste Generation

City	Municipal Solid Waste Generation (Ton/day)	Municipal Solid Waste Collection
Addis Ababa	1,132	70%
Mekele	78	82%
Dire Dawa	77	48%
Jimma	87	30%
Adama	59	48%
Bahir Dar	27	58%
Hawasa	46	44%
Harer	32	45%

Source - *Fikreyesus, D. (2011) "Ethiopia Solid Waste and Landfill"*

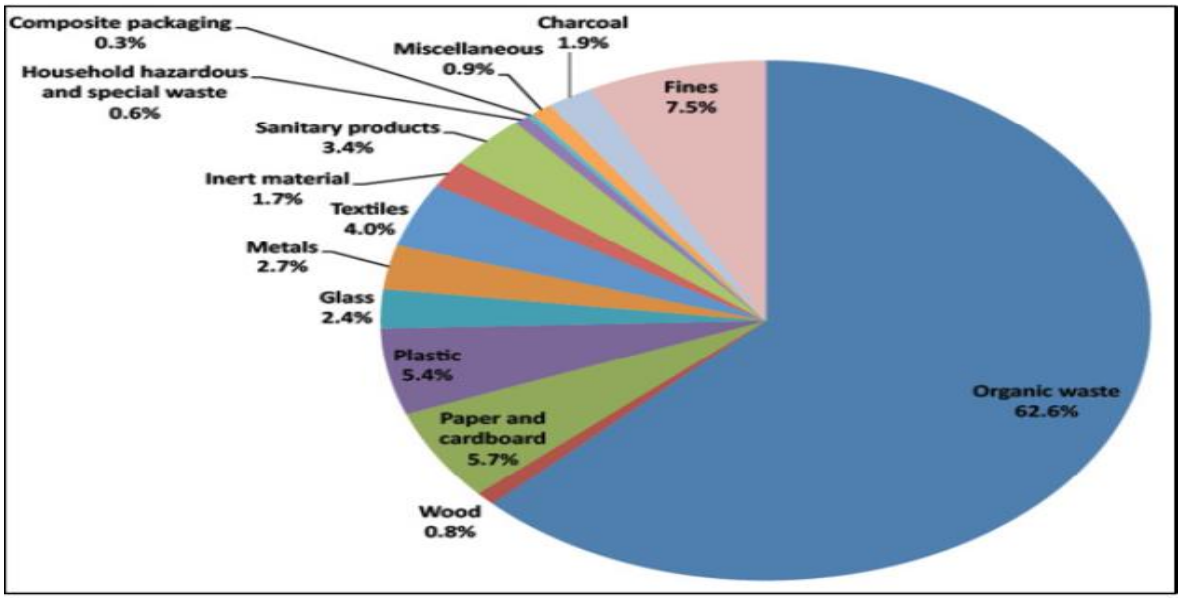
In general the per capita solid waste generation rate estimated by various studies is much higher for Addis Ababa as compared to the county's average and other cities and towns of the country.

The characteristics and quantity of the solid waste generated in a town is not only a function of the living standard and lifestyle of the country/region or inhabitants, but also of the abundance and type of the town's/region's or country's natural resources. Urban wastes can be subdivided into two major components–organic and inorganic. In general, the organic components of urban solid waste can be classified into three broad categories putrescible, fermentable, and non–fermentable. Putrescible wastes tend to decompose rapidly and unless carefully controlled, decompose with the production of objectionable odors and visual unpleasantness. Fermentable wastes tend to decompose rapidly, but without the unpleasant accompaniments of putrefaction.

Non–fermentable wastes tend to resist decomposition and, therefore, break down very slowly. A major source of putrescible waste is food preparation and consumption. As such, its nature varies with lifestyle, standard of living, and seasonality of food. Fermentable wastes are typified by crop and market debris (Ogawa, 2006).

The average physical composition of solid waste in Addis Ababa shows that 62.6% of the waste is organic waste, being the largest fraction. It is followed by fines (7.5%), paper and cardboard (5.7%), plastic (5.4%), textiles (4.0%), sanitary products (3.4%), glass (2.4%), charcoal (1.9%), inert material (1.7%), and metals (2.7%). All other fractions make up less than 1% of the composition each.

Figure 4.2: Composition of Waste In Addis Ababa (%)



Source - *IGNIS Joint Final Report, 2014*

However, the composition of waste varies along with the change in the socio-economic situation of the society and season. The organic content of the waste (fruits, leaves, vegetables) is much higher from September to January in all parts of the city, and decreases from February to August, as a result of heavy rainfall. Moreover, in areas where the living standard is high, materials such as paper, plastic and metal constitute a higher portion of the waste than in poorer areas. The above hypotheses are confirmed by a study under taken by IGNIS (see Table 4.2).

The composition by mass illustrates that organic waste, i.e. biodegradable waste coming from kitchens and gardens primarily, is the largest amount of the residual waste generated per household, followed by the fine fraction. The amount of organic wastes increases as the socioeconomic level increases, on the one hand because of higher purchasing power, and on the other, especially in the case of middle to high income housing, increasing area of garden within the compound. The amount of per capita paper and cardboard disposed in residual waste also increase as the socioeconomic level rises.

Table 4.2 : Yearly Per Capita Residual Waste Generation by Type and Income

	Low Income Housing	Low to Middle Income Housing	Middle Income Housing	Middle to High Income Housing	Condominiums	Total Averages
Organic waste	30.98	45.11	68.05	154.69	62.78	49.96
Wood	0.79	0.36	0.72	0.99	0.34	0.68
Paper and cardboard	3.59	3.13	5.67	10.66	7.03	4.58
Plastic	2.75	3.89	6.23	9.91	5.10	4.30
Glass	1.68	1.19	2.30	5.82	1.79	1.92
Metals	1.70	1.58	2.90	8.51	0.87	2.19
Textiles	3.24	3.35	3.43	3.16	2.04	3.22
Inert material	1.23	2.18	1.16	1.98	0.67	1.35
Sanitary products	0.27	1.23	5.66	12.02	5.64	2.68
Household hazardous and special waste	0.27	0.67	0.35	2.47	1.13	0.50
Composite packaging	0.12	0.15	0.27	0.78	0.41	0.21
Miscellaneous	0.65	0.50	0.95	0.98	0.70	0.72
Charcoal	1.12	1.58	1.82	2.48	2.80	1.56
Fines	6.71	7.16	4.21	14.48	1.32	5.99
Total	**55.09**	**72.08**	**103.73**	**228.94**	**92.59**	**79.85**

Source - *IGNIS Joint Final Report, 2014*

Accordingly, it can be concluded that there is adequate organic waste generated in Addis Ababa to support the operation of the envisaged project.

4.1.2 Raw Material Requirement and Cost

It is assumed that the required sorted organic waste will be provided by the city administration free of cost. Hence, the only input cost is bio compost facilitator and final products packing material (PP bags).

Bio compost facilitator (Compost 21, please see App 11) that costs Birr 1,000 for half a liter can be applied to 60-65 quintals of bio waste. Hence, given the annual organic waste processing capacity, at full capacity operation, is set at 8,690 tons, the required quantity (including 10% for wastage) and cost of bio compost facilitator is estimated at 765 liter and Birr 1,529,524.

Moreover, the final products packing material (PP bags) requirement (100 kg) capacity, at full capacity operation, including 10% for wastage, is estimated at 52,580 bags, the total annual cost of which, at a unit cost of Birr 15 per pieces is estimated at Birr 788,700.

The other major cost is fuel that is used in the composting processes and for transporting waste to the composting facility and final products to end users. It is assumed that the feedstock i.e. sorted organic waste will be collected from transfer stations, which will be located at a different distance from the composting facility. However, the average distance between the transfer stations and composting facility is assumed to be 20 km; hence the waste is transported over 20 km (one way) by a truck with a diesel consumption of 0.3 liter per km and a truck load of 15 tons. Therefore, considering a compost yield of 55%, the diesel fuel consumption for transporting feedstock for producing one tone of compost is estimated at 1.45 liters i.e. (40 km x 0.3 liter)/ (15 tons x 0.55)

Moreover, it is also assumed that the end product (compost) will be transported to farm gates, which on average are located at 30 km (one way) from the composting facility with a consumption of 0.3 lit diesel per km, with truck load of 20 tons.

Table 4.3 : Diesel Fuel Requirement

Sr. No.	Activity	Diesel Consumption Per Ton of Final Products
1	Transport of input materials (MSW)	1.45
2	Diesel used composting facility (e.g. turning of the compost etc.)	1.25
3	Diesel used for transporting compost to the farm	0.90
	Total	**3.60**

Hence, given the annual production capacity of 4,780 tons of compost, the annual diesel fuel requirement (including 10% for wastage) and cost (at a rate of Birr 62.36 per liter) is estimated at 18,928 liters and Birr 1,180,341.

Therefore, the total annual cost of materials and inputs, at full capacity operation is estimated at Birr 3,498,565 (bio compost facilitator Birr 1,529,524, packing material Birr 788,700 and diesel fuel Birr 1,180,341).

4.2 Utilities

The utilities required by the envisaged project consist of electricity and water. The annual total utility cost at full capacity of operation is estimated at Birr 848,169 (see Table 4.2).

Table 4.4 : Utility Requirement and Cost at Full Capacity Operation

Utilities	Unit	Qty.	Cost (Birr)
Electrical Energy	kwh	107,545	131,204
Water	M^3	35,848	716,964
Total			**848,169**

5 Enginnering

5.1 Machinery and Equipment

The required processing equipment includes front-end loaders, a grinder to prepare the waste after a basic visual control and manual sorting (to extract unwanted elements if necessary), turners, mixers, rotary trammel, bagging machine etc. Moreover, small equipment such as wheelbarrows (to transport waste and compost during the different steps of the process), shovels to return the windrows and to load the wheelbarrows, watering cans, and thermometers to check the temperature during the different fermentation stages are also required.

The total cost of the required machinery and equipment is estimated at Birr 9.38 million of which Birr 8.53 million is required in foreign currency. Table 5.1 shows the list of the required machinery and equipment and the associated cost.

Table 5.1 : List of the Required Machinery and Equipment and Cost (Details on App. 10)

Sr. No.	Description	Qty.	Unit cost (in USD)	Total cost (in USD)	Total cost (in Birr)
1	Turner	1	15,000	15,000	855,000
2	Shredder with classifier	1	25,000	25,000	1,425,000
3	Waste Drier	1	7,500	7,500	427,500
4	Mixer	1	15,000	15,000	855,000
5	Trommel	1	8,500	8,500	484,500
6	Front-end loader	1	50,000	50,000	2,850,000
7	Weighing scale	4	750	3,000	171,000
8	Pressure washer	1	1,750	1,750	99,750
9	Bagger	1	16,500	16,500	940,500
10	Hand tools	3 set	2,500	7,500	427,500
	Total FOB Price			**149,750**	**8,535,750**
	Insurance, bank charges, port handling, and inland transport (10%)			14,975	853,575
	Grand Total			**164,725**	**9,389,325**

Two medium duty trucks are required for transporting feedstock and final products, the total cost of which, at a rate of Birr 3.5 million per vehicle is estimated at Birr 7,000,000. Moreover, the envisaged plant requires office furniture and equipment such as chairs, tables, shelves, computers, for smooth running of the office work. The total cost of office furniture and equipment is estimated at Birr 514,000.

5.2 Land, Building and Civil Works

A composting plant comprises an operation area and a “green” buffer zone. The buffer zone, formed by a belt of bushes and trees surrounding the operation area, improves the visual appearance of the composting plant. The operation area is divided into different zones. It contains space for waste unloading and sorting, composting, maturing, sieving and bagging of the compost, including storage space for compost and recyclables. These zones must be arranged so as to ensure efficient workflow of the composting process.

On the basis of a feasibility study (Africompost, Decentralized Composting for Cities of Low- and Middle-Income Countries), on average, 1,000 m² of land is required to process 1,000 tons per year. Based on this information and including buffer zone, it is estimated that the envisaged project requires a total of 15,000 m² (1.5 hectares) of land.

Assuming that the envisaged project will be located in the outskirt of Addis Ababa, the total land lease cost, for a period of 60 years at a land lease rate of Birr 350 per m^2 is estimated at Birr 5.25 million of which 20% or Birr 1,050,000 will be paid in advance. The remaining Birr 4.20 million will be paid in equal installments within 20 years i.e. Birr 210,000 annually.

The unit construction cost rate is estimated based on sample past construction projects with similar construction material (sub structure, super structure and finishing), design and workmanship. Accordingly, the average unit cost of building and civil work is estimated at Birr 5,000 per square meter (lightweight building); hence the total cost of the building and civil work is estimated at Birr 10.25 million.

6 Human Resource and Training Requirements

6.1 Human Resource Requirement

The envisaged plant requires a total of 43 employees. The total annual cost of labour is estimated at Birr 6.60 million. Details of human resource requirement, including monthly and annual labour cost and employees benefit is given in Appendix 6.A.1. From the total annual cost of labor about 34% is accounted by safety equipment/materials and other employee benefits, which includes medical expenses, insurance, and other benefits. For details see Table 6.A.2

6.2 Training Requirement

Specialized training is required for operators with a lump-sum cost estimate of Birr 450,000.

7 Project Implementation

The implementation schedule covers the activities starting from the project evaluation and approval up to and including the trial run and commissioning. It is envisaged that the complete implementation program requires a total of 12 months.

Project implementation costs are pre-operation expenses which include costs of project management, design, erection and commissioning of machinery and equipment, detailed engineering of building and civil works and consultancy services. The total cost of implementation is estimated at Birr 2.1 million.

8 Financial Analysis

8.1 Assumptions

The financial analysis of the project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	1 year
Operation period	10 years
Source of finance	30 % equity & 70 % loan
Bank interest	12%
Loan repayment	10 years
Cash flow Discounting	15%
Tax holidays	5 years
Accounts receivable	30 days
Work in progress	21 day
Finished products	15 days
Cash in hand	5 days
Accounts payable	30 days
Repair and maintenance	10% of machinery cost and 5% of the cost of building and civil works

8.2 Result of the Financial Analyses

8.2.1 Total Initial Investment Cost

The total investment cost of the project including the initial working capital is estimated at Birr 37.44 million (see Table 9.1). From the total investment cost the highest share (Birr 28.19 million or 75.30%) is accounted by fixed investment cost followed by pre operation cost (Birr 8.07 million or 21.57%) and initial working capital (Birr 1.17 million or 3.13%).

Table 8.1 : Initial Investment Cost ('000 Birr)

Sr. No.	Cost Items	Total Cost	% Share
1	**Fixed investment**		
1.1	Land lease	1,050.00	2.80
1.1	Building and civil work	10,250.00	27.37
1.2	Machinery and equipment	9,389.33	25.07
1.3	Vehicles	7,000.00	18.69
1.4	Office furniture and equipment	510.00	1.36
	Sub total	**28,199.33**	**75.30**
2	**Pre operating cost ***		
2.1	Pre-production costs	2,550.00	6.81
2.2	Interest during construction	5,526.99	14.76
	Sub total	**8,076.99**	**21.57**
3	**Working capital ****	**1,171.10**	**3.13**
	Grand Total	**37,447.42**	**100**

** Pre operating cost includes project implementation cost such as installation, startup, commissioning, project engineering, project management etc. and capitalized interest during construction.*

*** The total working capital required at full capacity operation is Birr 1.61 million. However, only the initial working capital of Birr 1.17 million during the first year of production is assumed to be funded through external sources. During the remaining years the working capital requirement will be financed by funds to be generated internally (for detail working capital requirement see Appendix 9.A.1).*

8.2.2 Production Cost

The annual production cost at full operation capacity is estimated at Birr 18.91 million (see Table 9.2). The cost of labour account for 22.99% of the production cost. The other major components of the production cost are depreciation, raw material and financial cost, which account for 18.83%, 18.50% and 11.84%, respectively. The remaining 27.84% is the share of cost of utility, maintenance and repair, labor overhead and administration costs. For detail production cost see Appendix 9.A.2.

Table 8.2 : Annual Production Cost at Full Capacity (Year Three)

Item	Cost	% Share
Raw Material and Inputs	3,498.56	18.50
Utilities	848.17	4.48
Maintenance and repair	1,451.43	7.67
Labour	4,348.80	22.99
Labour overheads	2,256.50	11.93
Administration Costs	500.00	2.64
Land lease cost	210.00	1.11
Total Operating Costs	**13,113.46**	**69.33**
Depreciation	3,560.54	18.83
Cost of Finance	2,239.66	11.84
Total Production Cost	**18,913.66**	**100**

8.2.3 Revenue

Based on the selected capacity and the recommended factory gate price the annual revenue generated by the envisaged plant at full capacity operation is estimated at Birr 23.89 million (see Table 9.3).

Table 9.3 : Projected Annual Revenue (in 000 Birr)

Year	1	2	3 and above
Capacity utilization (%)	75	85	100
Revenue	14,339	19,119	23,899

8.2.3 Financial Evaluation

a) Profitability and Cash Flow

Based on the projected profit and loss statement, the project will generate a profit throughout its operation life. Annual net profit after tax ranges from Birr 1.94 million to Birr 7.37 million during the life of the project. Moreover, the projected cash flow of the envisaged project also shows that the project would generate positive net cash flows throughout the operation years. At the end of the project life the accumulated net cash flow amounts to Birr 59.78 million. For profit and loss statement and cash flow projection see Appendix 9.A.3 and 9.A.4, respectively.

b) Internal Rate of Return and Net Present Value

The IRR of this project is computed to be 20.65% indicating the viability of the project. The net present value of the project at 15% discount rate is found to be Birr 7.71 million which is acceptable. For detail discounted cash flow see Appendix 9.A.5.

c) Break-Even Analysis

The break-even analysis establishes a relationship between operation costs and revenues. It indicates the level at which costs and revenue are in equilibrium. To this end, the break-even point for capacity utilization and sales value estimated by using income statement projection are computed as followed.

Break -Even Sales Value = Fixed Cost + Financial Cost = Birr 13,874,730

Variable Margin ratio (%)

Break- Even Capacity utilization = Break- even Sales Value X 100 = 58%

Sales revenue

b) Pay-back Period

The pay –back period, also called pay – off period is defined as the period required for recovering the original investment outlay through the accumulated net cash flows earned by the project. Accordingly, based on the projected cash flow it is estimated that the project's initial investment will be fully recovered within 5 years.

8.2.4 Sensitivity Analyses

The reliability of the financial analyses depends on the accuracy of the cash flow calculations, i.e. the projected cash flows and their timings. Each input parameter is affected by many risks and uncertainties, which may have a significant impact on the outcome of the financial feasibility analysis, and therefore needs to be accurately captured in the decision-making process.

Sensitivity analysis can give decision makers an insight into project risk associated with changes in input parameters. As the values of input parameters are often subject to great uncertainty it can be very beneficial to examine the project's outcome given a change in these parameters. Sensitivity analysis also highlights which parameters influence the results the most and should therefore be considered key parameters.

Sensitivity analysis is conducted by determining how much output values change relative to a given change in input parameters. First a base case is defined from the most likely values for each variable. These are the same values as used for the financial feasibility assessment described above. One variable at a time is changed by a specified percentage, above the most-likely value, and other variables are held constant at the base case value. The output is then calculated for the new value; in this case the output being either NPV or IRR.

To see the rate of change in IRR for a unit change in operation cost, investment cost and revenue around the central value i.e. elasticity of IRR is computed, which shows that the project is more sensitive to changes in revenue and operating cost, than investment cost (see Table 9.4).

Table 8.4 : Elasticity of IRR

Sr.No.	Parameter	IRR	Proportionate change in IRR	Elasticity
1	Normal case	20.65		
2	10% increase in operation cost	17.22	-0.166	-1.38
3	10% increase in investment cost	17.93	-0.132	-1.10
4	10% decrease in total revenue	15.09	-0.269	-2.24

As can be seen from Table 9.4 a decrease of 10% in revenue or a decrease of 10% in selling price i.e. from Birr 500 per quintal to Birr 455 per quintal will reduce the IRR of the project to 15.09%, which is very close to the cutoff rate of 15%. The NPV will also become Birr 124 thousand, which is marginal.

Switching value, which is a value beyond which the project turns out to be financial unviable or not feasible for selling price is a 12% decline in revenue or a selling price of Birr 446 per quintal. Assuming that the investment and operating cost are constant and at a selling price of Birr 446 per quintal, the IRR and NPV of the project becomes 13.58% and Birr -1.89 million, indicating that the project will not be financial viable.

The switching value for operating and investment cost is an increase of 21% and 29%, respectively (see Table 9.5).

Table 8.5 : Switching Value

Sr. No.	Parameter	Switching Value	IRR in %	NPV (in 000 Birr)
1	Decrease in selling price	12% (446 Br)	13.58	-1,892
2	Increase in operation	21%	14.14	-124.00
3	Increase in investment	29%	14.56	-733

Business Case, conditional feasibility

The above analysis shows that the compost business could be feasible with a minimum selling price per quintal of 446 Birr, although there are environmental and economic factors that argue for long term benefits. The study has also included a sensitivity analysis shown above. This selling price could also be subsidized in the form of land provision and cost subsidy, until the costs that could make a break-even will be reached. The study also observed that whereas the compost price of about 500 could still be affordable for vegetable farmers and those engaged in urban ornamental plants and flowers business, grain and farmers residing in the Sheger City state a compost price between 140 to 200 ETB per quintal matches their annual fertilizer budget. The following development can take place, if the institutional and government subsidy support takes place.

The Koshe Landfill has the potential to collect approximately 42,000 tons of organic waste per year, if we consider only 250 organic waste dumping days.
With 21 days per one batch, there would be about 17 batches of composting per year. With the composting capacity of 500 tones per batch, in a year about 9000 tons of organic waste can be composted and marketed.
Considering the total organic waste stock, 5 similar projects can be launched at the Nefas Silk Lafto or Koshe Landfill only.

Appendix

Appendix 6.A.1: Human Resource Requirement and Labor Cost

Sr. No.	Job Title	Required No. of Persons	Salary, Birr	
			Monthly	Annual
1	Plant manager	1	30,000	360,000
2	Secretary	1	7,500	90,000
3	Personnel	1	15,000	180,000
5	Accountant	2	20,000	480,000
6	Cashier	1	12,500	150,000
7	Salesman /Purchaser	2	15,000	360,000
8	Store keeper	1	12,500	150,000
9	Production and technical manager	1	25,000	300,000
10	Production supervisor	2	12,500	300,000
11	Reception area	3	5,500	198,000
12	Hand sorting area	10	5,500	660,000
13	Shredding area	2	5,500	132,000
14	Fermentation area	2	5,500	132,000
15	Maturing area	6	5,500	396,000
16	Screening area	2	5,500	132,000
17	Driver	2	6,000	144,000
18	Guard	4	3,850	184,800
Sub – Total		**43**		**4,348,800**
Employees Benefit				**2,256,496**
Grand – Total				**6,605,296**

Appendix 6.A.2: Estimated Annual Cost of Safety Equipment/Materials and Other Employee Benefits

Sr. No.	Description	Annual Cost (in Birr)
1	Pension contribution (12 % of salary)	521,856
2	Medical Allowance (one month salary)	362,400
3	Uniform and Safety equipment/materials (@ Birr 10,000 per head)	430,000
4	Employees Insurance (5% of salary)	217,440
5	Bonus (Two month salary)	724,800
	Total	**2,256,496**

Appendix 9.A.1: Net Working Capital (In 000 Birr)

Item	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Total inventory	700	700	875	875	875	875	875	875	875	875
Accounts receivable	679	886	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093
Cash-in-hand	82	107	132	132	132	132	132	132	132	132
Current assets	**1,461**	**1,693**	**2,099**	**2,099**	**2,099**	**2,099**	**2,099**	**2,099**	**2,099**	**2,099**
Accounts payable	290	387	483	483	483	483	483	483	483	483
Current liabilities	**290**	**387**	**483**	**483**	**483**	**483**	**483**	**483**	**483**	**483**
Total working Capital	**1,171**	**1,306**	**1,616**	**1,616**	**1,616**	**1,616**	**1,616**	**1,616**	**1,616**	**1,616**
Increase in working Capital	1,171	135	310	-	-	-	-	-	-	-

Appendix 9.A.2: Production Cost (in 000 Birr)

Item	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Raw Material and	2,099	2,799	3,499	3,499	3,499	3,499	3,499	3,499	3,499	3,499
Utilities	509	679	848	848	848	848	848	848	848	848
Maintenance and	871	1,161	1,451	1,451	1,451	1,451	1,451	1,451	1,451	1,451
Labour	2,609	3,479	4,349	4,349	4,349	4,349	4,349	4,349	4,349	4,349
Labour overheads	1,354	1,805	2,256	2,256	2,256	2,256	2,256	2,256	2,256	2,256
Administration Costs	500	500	500	500	500	500	500	500	500	500
Land lease cost	210	210	210	210	210	210	210	210	210	210
Total Operating Costs	**8,152**	**10,633**	**13,113**	**13,113**	**13,113**	**13,113**	**13,113**	**13,113**	**13,113**	**13,113**
Depreciation	3,561	3,561	3,561	3,561	3,561	256	256	256	256	256
Cost of Finance	2,986	2,613	2,240	1,866	1,493	1,120	747	373	-	-
Total Production Cost	**14,699**	**16,806**	**18,914**	**18,540**	**18,167**	**14,490**	**14,116**	**13,743**	**13,370**	**13,370**

Appendix 9.A.3: Income Statement (in 000 Birr)

Item	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Sales revenue	14,339	19,119	23,899	23,899	23,899	23,899	23,899	23,899	23,899	23,899
Less variable costs	7,942	10,423	12,903	12,903	12,903	12,903	12,903	12,903	12,903	12,903
Variable margin	**6,397**	**8,696**	**10,995**	**10,995**	**10,995**	**10,995**	**10,995**	**10,995**	**10,995**	**10,995**
In % of sales revenue	44.61	45.48	46.01	46.01	46.01	46.01	46.01	46.01	46.01	46.01
Less fixed costs	3,771	3,771	3,771	3,771	3,771	466	466	466	466	466
Operational margin	**2,627**	**4,926**	**7,225**	**7,225**	**7,225**	**10,529**	**10,529**	**10,529**	**10,529**	**10,529**
In % of sales revenue	18.32	25.76	30.23	30.23	30.23	44.06	44.06	44.06	44.06	44.06
Financial costs	0	2,986	2,613	2,240	1,866	1,493	1,120	747	373	0
Gross profit	**2,627**	**1,940**	**4,612**	**4,985**	**5,358**	**9,036**	**9,409**	**9,783**	**10,156**	**10,529**
In % of sales revenue	18.32	10.14	19.30	20.86	22.42	37.81	39.37	40.93	42.50	44.06
Income tax	-	-	-	-	-	2,711	2,823	2,935	3,047	3,159
Net profit	**2,627**	**1,940**	**4,612**	**4,985**	**5,358**	**6,325**	**6,586**	**6,848**	**7,109**	**7,370**
In % of sales revenue	18.32	10.14	19.30	20.86	22.42	26.47	27.56	28.65	29.75	30.84

Appendix 9.A.4: Cash Flow for Financial Management (in 000 Birr)

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Scrap
Total cash inflow	**33,290**	**18,497**	**19,409**	**23,995**	**23,995**	**23,899**	**23,899**	**23,899**	**23,899**	**23,899**	**24,382**	**11,786**
Inflow funds	33,290	4,157	290	97	97	-	-	-	-	-	483	-
Inflow operation	-	14,339	19,119	23,899	23,899	23,899	23,899	23,899	23,899	23,899	23,899	-
Other income	-	-	-	-	-	-	-	-	-	-	-	11,786
Total cash outflow	**33,290**	**12,309**	**16,864**	**19,147**	**18,464**	**18,090**	**20,428**	**20,167**	**19,905**	**19,644**	**16,272**	**483**
Increase in fixed assets	33,290	2,986	-	-	-	-	-	-	-	-	-	-
Increase in current assets	-	1,171	135	310	-	-	-	-	-	-	-	-
Operating costs	-	8,152	10,633	13,113	13,113	13,113	13,113	13,113	13,113	13,113	13,113	-
Income tax		-	-	-	-	-	2,711	2,823	2,935	3,047	3,159	-
Financial costs	-	-	2,986	2,613	2,240	1,866	1,493	1,120	747	373	-	-
Loan repayment	-	-	3,111	3,111	3,111	3,111	3,111	3,111	3,111	3,111	-	483
Surplus (deficit)	**-**	**6,187**	**2,545**	**4,849**	**5,532**	**5,808**	**3,471**	**3,732**	**3,993**	**4,255**	**8,110**	**11,303**
Cumulative cash balance	**-**	**6,187**	**8,732**	**13,580**	**19,112**	**24,921**	**28,391**	**32,123**	**36,117**	**40,372**	**48,482**	**59,785**

Appendix 9.A.5: Discounted Cash Flow (in 000 Birr)

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Scrap
Total Cash Inflow	**-**	**14,339**	**19,119**	**23,899**	**23,899**	**23,899**	**23,899**	**23,899**	**23,899**	**23,899**	**23,899**	**11,786**
Inflow operation	-	14,339	19,119	23,899	23,899	23,899	23,899	23,899	23,899	23,899	23,899	-
Other income	-	-	-	-	-	-	-	-	-	-	-	11,786
Total Cash Outflow	**33,290**	**12,309**	**10,768**	**13,423**	**13,113**	**13,113**	**15,824**	**15,936**	**16,048**	**16,160**	**16,272**	**-**
Increase in fixed assets	33,290	2,986	-	-	-	-	-	-	-	-	-	-
Increase in net working capital	-	1,171	135	310	-	-	-	-	-	-	-	-
Operating costs	-	8,152	10,633	13,113	13,113	13,113	13,113	13,113	13,113	13,113	13,113	-
Income (corporate) tax	-	-	-	-	-	-	2,711	2,823	2,935	3,047	3,159	-
Net Cash Flow	**(33,290)**	**2,030**	**8,351**	**10,476**	**10,785**	**10,785**	**8,075**	**7,963**	**7,851**	**7,739**	**7,627**	**11,786**
Cumulative Net Cash Flow	**(33,290)**	**(31,260)**	**(22,909)**	**(12,433)**	**(1,648)**	**9,137**	**17,212**	**25,175**	**33,025**	**40,764**	**48,390**	**60,177**

Net Present Value (@15%)	7,718
Internal Rate of Return	20.65%
Payback	5 years

Appendix 10

1. **Turner**

Price=

1 - 2 sets ……. $14,500.00, 3 - 4 sets……...$13,500.00

5 - 9 sets……...$12,500.00, >= 10 sets…… $11,500.00

Material link=
https://s.alicdn.com/@sc04/kf/Ha8a453d7fe6e4b8a96ed6bba9489a253T.jpg_720x720q50.jpg

2. Shredder with classifier

Price=

1- 2 units…….. $24,960.00

3- 4 units……..$23,960.00, >= 5 units…… $22,680.00

Material link=

https://s.alicdn.com/@sc04/kf/H01e2c541f3234f3a90eb28749f60fffcf.png_720x720q50.png

3. Waste Drier

Price=

>= 1 sets…….. $7,400.00

Material link=
https://s.alicdn.com/@sc04/kf/H4a5b26eb8b4d47108d8fae0b582b267c2.jpg_720x720q50.jpg

4. Mixer

Price=

1- 3 sets…… $14,821.00

4- 9 sets…… $12,672.00

>= 10 sets…….. $10,448.00

Material link=

https://s.alicdn.com/@sc04/kf/Hc7c8b1cec02f493dbf29e7debb5c14ff0.jpg_720x720q50.jpg

5. Trommel

Price= $4,100.00 - $20,730.00

Material link= https://s.alicdn.com/@sc04/kf/Ha03b42e0e5e24a179280953e64d81eddc.jpg_720x720q50.jpg

6. Front-end loader

Price=

1 - 7 units…….. $49,900.00

8 - 15 units…… $48,900.00, >= 16 units…… $43,500.00

Material link=

https://s.alicdn.com/@sc04/kf/Hae806c7ff8fc4505887c269b02187779d.jpg_720x720q50.jpg

7. Weighing scale

Price=

1 - 1 sets…….. $750.00

2 - 4 sets…….. $720.00

>= 5 sets…….. $700.00

Material link=

https://s.alicdn.com/@sc04/kf/H8531d5da77cf458488def1ea5681af9aJ.jpg_720x720q50.jpg

8. Pressure washer

Price=

>= 5 sets…….. $1,750.00

Material link=
https://s.alicdn.com/@sc04/kf/H33292bfb879e41e3adee7a3b71a45edby.jpg_720x720q50.jpg

9. Bagger

Price=

1 - 4 sets…….. $16,500.00

>= 5 sets…….. $14,888.00

Material link=
https://s.alicdn.com/@sc04/kf/Hae35aa3769dd494b93b4fdbe8abdd00f3.png_720x720q50.png

10. Hand tools

Price=

Material link=
https://s.alicdn.com/@sc04/kf/H0db8f0abcc75414486e649f5f6a5ca71U.jpg_720x720q50.jpg

Appendix 11

Top Organic Fertilizer & Pesticide PLC.

BRIEF DESCRIPTION OF TOP ORGANIC FERTILIZER & PESTICIDE PLC

TOP Organic Fertilizer & Pesticide Private Limited Company is a locally registered agriculture inputs manufacturer primarily producer of organic compost facilitator, organic fertilizer & pesticide. TOP is an innovative agricultural solutions provider formally registered in September 2022 with its principaladdress situated at Tigray, Mekelle, Hadinet Kifle Ketema, Semret Kebele in Ethiopia. Even though, TOP was victim of the siege and blockage like any other company in the region, during the same period, it was contributing in providing farmers with compost facilitator and liquid fertilizer which are innovative local solutions.

Currently TOP have six agricultural innovations namely:

1. Compost 21
2. Organic Liquid Fertilizer
3. Cochineal Insect Pesticide
4. Organic Pesticide
5. Organic Hydroponic Fertilizer
6. Organic Cockpit Fertile Soil

Compost 21 is Organic Liquid Compost Facilitator made of herbal leaves,flowers, etc. It is well known that conventional compost production period at farmers level is from 4 to 6 months before the final product is released for use. With the use of Compost 21, the length to produce matured compost is reduced to only 21 days. Compost 21 brought on average of 714% efficiency over the conventional procedure. This also brings substantial reduction of the productioncost of compost to farmers and compost producers. The benefit of using Compost21 have also significant different advantages over the conventional one. The following table depicts some of them.

Comparison of Conventional Compost vs Compost 21

No.	Parameter	Conventional Compost	Compost 21
1	Maturity Time	4-6 months	21 days (571-857%)
2	Quantity of Pits for 1 period	2	1
3	Manual Aeration	Every 3 weeks	No need
4	Shade	Required	Not Required
5	Working Season	Warm season	All seasons
6	Transmit – Fungus	Yes	No
7	Transmit – Weeds	Yes	No
8	Input Options	Limited	Increased (Weeds, Manure, Soil, - Peritoneum, dry waste, Prosopy, Chat leaves,
9	Smell during aeration	Yes	No
10	Cost of production	Expensive	Cheap (reduced by 60-70%)

Thus, it is possible to say that , Compost 21 provides relief to compost manufacturers (smallholder farmers and private SMEs engaged in compostproduction and off course large scale farmers too) by allowing them to produce better, healthier, economically viable and efficient compost sustainably. It will have also tremendous advantage to create job opportunity to youth and females in urban cities to change the dray waste to value added products.

TOP Organic Fertilizer & Pesticide aims:

- to increase smallholder farmers' access to fertilizer,
- to enhance the resilience of the Ethiopian fertilizer market and supplychain,
- to create job opportunity and contribute in making cities healthier and sufficient producers of vegetable for their consumption.
- supply organic agricultural inputs to develop backyard and elevation agricultures in cities across Ethiopia.

To realize these aims, TOP aspires to expand its service and products to other regions of Ethiopia with different modality of stakeholder engagements with thesupport of donor partners.

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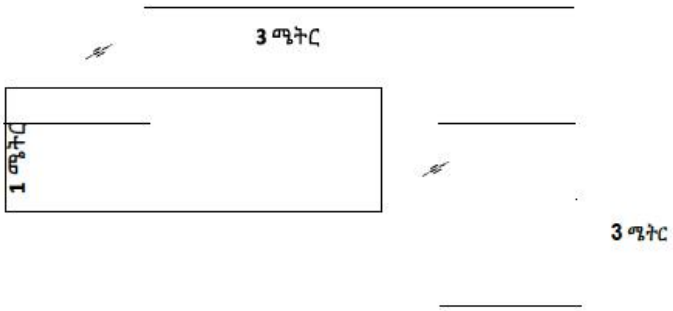
Input & Material Preparation to make compost using Compost 21



Know the nature, protect the environment

Annex 12

Interview note for the interview and focus group discussion with the farmers form the Sheger Sub city

23.01.2024

One quintal of inorganic fertilizer is about 4500 ETB per quintal. Farmers in Sheger spend 0,5 quintals of DAP and 0,5 Urea for 1 hectare of land. This would be 4500 ETB for both types of fertilizers. The land in Shger city is still fertile and doesn't require much fertilizer.

The access of fertilizer is at times challenging. Some of it ends in the hands of merchants, who would sell it almost for double (about 8000 to 9000 ETB) the distribution price. Last year, farmers had to spend some nights waiting in queues for the fertilizer. DAP and UREA are imported, and its distribution isn't enough. The supply of inorganic fertilizer was very limited. Some farmers expected to get 4 quintals and received only 1quntal of fertilizer. Prices reached up to 12000 ETB – by speculating traders. Traders find their way either through direct import or corrupt practice. On the other hand, the inorganic fertilizer is easily transported and spread on the plots and makes the plants beautiful.

The local Agriculture Bureau provided training on compost production to the Development Agents (DAs) and the DAs in turn provide training to farmers. Some farmers attended the training and produced some amount of compost for their vegetable plots. In Gefersa Guje Sub city, Guolobo Woreda a person sold compost for 20,000 ETB.

There is a huge demand for compost, but compost is not available in the market. Some people apply cow manure from their households instead of compost, but this also depends on the distance from the house to the farm. The farther the location of the plot, the less the application of cow manure on the plots.

There is an interest in using the compost, but the price will depend on the market. Compost is expensive and not affordable for many farmers. It is also costly to transport due to the bulk that is required for small plots of land.

Farmers buy chicken manure for about 200 ETB per quintal because the inorganic fertilizer isn't available every time they need it. Eco green is an additional liquid fertilizer. An amount 1-5 litter is applied to activate the land in addition to the inorganic fertilizer. 5 lit of Eco green is sold for 280 ETB. There is also a litter Eco green (thick) option 1300 ETB. Eco green has been used for about 4 years in Sheger area.

The one question is how much compost do we need for the application instead of the inorganic fertilizer. For example, 1 quintal of compost is enough only for about 300 sq. meter of land. In order to cover 10, 000 sq m (1 ha) of land, about 30 quintals of compost should be applied. The argument should be about balancing the price of inorganic and organic fertilizers. This implies that the price of one quintal of compost should be as low as 140 ETB. The compost price should be lowered at least as a motivation to apply it.

So, compost or cow manure should be used as additional input to land husbandry and not a substitute. There are different inputs to be used as well, such as lime. Irrigation land needs rehabilitation and will need more compost. The availability of compost may make it advantageous due to serious shortage of fertilizer. Compost also keeps the fertility of the soil for some years after its application. But the farmers are of the opinion that the land requires compost every year. Some depleted land should be rehabilitated intensively together through the application of the inorganic fertilizer.

Farmers Interviewed

No.	Name	Address
1.	W/ro Diribwork Aweke	Kolobo wereda, markos kebele
2.	Ato Siyum Negash	Kolobo wereda, markos kebele
3.	Gadisa Urga	Anne Dima
4.	Teklu Getachew	Gefersa Burayu
5.	Abush Tesema	Burayu
6.	Abiyot Driba	Burayu

Annex 13

Price modeling for compost versus inorganic fertilizer application

Inorganic application per ha.

Price per quintal	1	2	3	4
4500	4500	9000	13500	18000
5000	5000	10000	15000	20000
6000	6000	12000	18000	24000
7000	7000	14000	21000	28000
8000	8000	16000	24000	32000

Compost application per ha.

Price per qunital	10	15	15	20	25
200	2000	3000	3000	4000	5000
300	3000	4500	4500	6000	7500
400	4000	6000	6000	8000	10000
500	5000	7500	7500	10000	12500