



PROJECT PROFILE ON DATACENTER SERVICE



NOVEMBER 24, 2022

ADDIS ABEBA CITY ADMINISTRATION INVESTMENT COMMISSION

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PROJECT PROFILE ON DATACENTER SERVICE

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I. Executive summary

This project profile is prepared to assess the viability of building a datacenter, in Addis Ababa city administration to give datacenter services of collocation, hosting and leasing computing infrastructure and application. Hence, Market, Technical, Organizational and Financial study was made to investigate the viability of the envisaged project.

This project profile on datacenter services has been developed to support the decision –making process based on a cost benefit analysis of the actual project viability. This profile includes marketing study, service and financial analysis, which are utilized to assist the decision-makers when determining if the business concept is viable. Ethiopia has already started hosting a private sector driven datacenter service in the technology sector. According to the latest data sourced from the ministry of Trade and industry there are around 20 registered private datacenter service providers in Ethiopia. None of them has started their production site to give service. A few of them has started building civil work.

While the primary need for the location is sufficient electric power supply and the availability of high bandwidth Internet service, Addis Ababa is well fitting city for both. It is also a common destination place for the required devices to be imported.

The datacenter at full capacity can give collocation service, in one containment, for up to 10 clients, giving one rack per client, and website hosting service to hundreds of organizations/individuals. The number of containment will be determined by the size of investment. A minimum of four containments is cost effective that it can be served by one generator and same power supply. In this

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profile, we are proposing eight to sixteen containments for the optimal return on investment and accommodating significant number of clients which make reliable market share.

The datacenter will be housed in a new construction designed for this specific purpose. Alternatively, the datacenter can be set in a leased building floor where the civil work of enhancing the bearing capacity of the floor and reinforcement of the walls is properly done. Both ways, the high power electric line and broadband lines to the datacenter facility will be considered.

The total investment capital of the tier3 datacenter, considering 16 containments is Birr five hundred eighty million. Out of the total investment capital, the owners will cover Birr 174million (30 %) while the remaining balances amounting to Birr 406 million (70 %) will be secured from bank in the form of term loan.

As indicated in the financial study, the cash flow projection of the project shows surplus from the day of launching the service on. At present **least rate** given by a government service provider and an assumption of renting all racks (with 5KVA power for each), it will generate 16,000,000 birr per month (192,000,000 birr annually). This increases in the private sector with better quality of service. The income doubles with double number of containment/rack. The biggest expense is running cost of electric power. The rough calculation on current tariff of Industrial High Voltage, considering 1120 KVA, is about 9,000,000 birr annually.

As indicated in the financial study, the cash flow projection of the project shows surplus from the first year on. The net cash flows of the project range from Birr 42.64 Million in the first year to Birr 31.33 million at the end of the 10th year of operation. At the end of the 10th year of operation period the cumulative cash balance reaches Birr 535.46 million. The Benefit-cost ratio and Net present

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value (NPV) have been calculated at 17% discount factor (D.F) for 10 years of the project activity. Accordingly, the project has NPV of 128.40 million Birr at 17%D.F. and the benefit-cost ratio of 1.18 at 17% D.F.

Therefore, from the aforementioned overall market technical and financial analysis we can conclude that the datacenter service providing business is a viable and worthwhile. Considering only the major expense of power, in 16 containment investment, the investment is fully returned in 7 years and it has an annual income projection of 192, 000, 000 birr. The whole calculation is based on the minimum renting service provided by the government owned Ethio telecom

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1. Background information

1.1. Introduction

This document was prepared to show Datacenter/ investment profile in Addis Ababa. In compiling the report, information from Addis Ababa investment commission, Addis Ababa trade and industry development, Ethiopian custom and revenue commission, Ethiopian investment commission (EIC), Central statistics agency (CSA) and, other published sources have been augmented.

The contribution of the Information Technology sector to the national economy is minimal compared to its potential. One of the main causes of this mismatch between population size and service provision output from datacenter facilities and computing systems in Ethiopia is attributed to different factors like the little awareness and demand of the population, the fact that we are latecomers to the global digital landscape and the fact that domestic investors are not aware of the existing market for such service.

1.2. Significance of Datacenters

Almost every modern business and government offices need their very own data center, or they may opt to lease one. Big corporations and government institutions may choose to build and manage them in-house if they have the resources. While others choose to rent servers at ‘colos’ or colocation facilities. Some business owners also have the choice to use public cloud-based services.

Corporations that handle education, finance, telecommunication, retailers, and social networking services process tons of information every day. These businesses that produce and utilize data requires data centers in running their operations. Without these centers, they will suffer the absence of speedy and secure access to data. This failure in delivering services will ultimately lead to the loss of clients and profits.

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Data centers play a fundamental role in our society and digital economy. Everything that happens online, is housed in a data center. In most of the cities, our life relies on the functioning and availability of one or multiple data centers. It is not an overstatement. Most of the things in every segment of human activity such as energy, lighting, telecommunications, internet, transport, urban traffic, banks, security systems, public health, entertainment and even our physical integrity are controlled by data centers.

The increase in use of data centers also shows through the recent rise of the stock prices of data centers. The stock market - especially the rising stock prices and high investments - shows the importance of the digital infrastructure since the outbreak of the pandemic. The need for data centers has risen steadily across the globe, even before the pandemic. For example, the number of data centers in Africa has doubled in the past three years. The pandemic and lockdowns have only accelerated this existing trend. It is expected that data centers will continue to play a crucial role in the data economy of cities and countries across the world.

Currently, the businesses thrive on internet and data. Therefore, data backup is the first-step protection that businesses can have to ensure smooth operations. It is also used to protect the organization's data against damage, theft, software failure, and disaster.

With a dependable datacenter, the organization can retrieve the data in case that they are damaged or interrupted. Unlike physical assets, such as buildings, which can be resurrected through insurance in case of fire or natural disaster, lost data are incurable unless you have their backup. This is why data center is particularly important for a business.

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1.3. Service description

Data centers house many digital applications and thus form the foundation of our Internet. In these buildings full of servers and other digital equipment, videos and other files are stored, important software runs and data is exchanged between different networks that form a data distribution hub.

Data centers in any society support a wide range of activities of the government, business and society.

Data center is a centralized location rendered with computing resources and crucial telecommunications which includes servers, storage systems, databases, devices, access networks, software and applications. Any company or organization that handles its users' data must need data centers. In other words, if you have an account on any website, or if you have used the internet to search for anything at all, you are definitely taking up some space in a data center located in some corner of the world.

Data centers are typically referred to as a singular entity, but they are actually made up of racks, cabinets, cables, batteries, and backup generators in case of a power breakdown. Because they store up to billions of megawatts of information, they also have cooling systems to keep them from overheating.

A containment is a closed unit of space where the partitioning glass is sealed for air conditioning. it hosts coolers, server racks, power supply to each rack and data connection supply. It also has physical security controls and monitoring camera. It accommodates up to 14 racks out of which 10 racks will be available for service or renting.

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Data centers host computing and storage systems to enable the delivery of web services. The design of the facility depends on the computing and storage resources. The key components of the design include routers, switches, firewalls, storage systems, servers, and application-delivery controllers. Different types of data, including open data, is stored in data centers.

1.4. Project location and justification

1.4.1. Location of Addis Ababa

Addis Ababa is the seat of the Ethiopian federal government. It is located on the central highlands of Ethiopia in the middle of Oromia Region. The absolute location is around the intersection point of 9°1'48''N latitude and 38°44'24"E longitudes. This is very near to the geographical center of the country. It is, therefore, equidistant to the peripheral areas or is equally accessible to almost all parts of Ethiopia. Addis Ababa is located on a well-watered plateau surrounded by hills and mountains. The city is in the highlands on the edge of the Ethiopian rift valley or the eastern slopes of the Entoto Mountain ranges bordering the Great Rift Valley. The total area of Addis Ababa is about 540 km² of which 18.2 km² are rural. Addis Ababa's built-up urban area spans 474 km². It is also the largest city in the world located in a landlocked country.

1.4.2. Demography of Addis Ababa

According to the Worldometer report, Ethiopia's total population reaches about 120 million people in 2022. Of the total population 21% (25.2 million people) live in urban areas. Ethiopia's urban population is expected to triple by 2037 (World Bank, 2015). Addis Ababa hosts an estimated 5,228,000 people. Currently, Addis Ababa is experiencing an annual growth rate of 4.42%.

1.4.3. Economic activity of Addis Ababa

The transformation of Addis Ababa has especially been rapid since 1991. According to the data from the city's Bureau of Finance and Economic Development (2006), per capita income of Addis Ababa has grown from USD 788.48 in 2010 to USD 1,359 in 2015. The city also achieved a decline in the poverty index from a high of 29.6 in 2012 to 22.0 in 2014. Moreover, the current poverty headcount index for Addis Ababa is estimated at 18.9 while the poverty severity account for 5 and 1.8 index points respectively. Even though, the poverty status of Addis Ababa has an improvement over previous years, there is still much work to be done to curb both the incidence and severity of poverty.

The major contributor to the economic growth of the city is the implementation of publicly financed mega urban projects like condominium housing, the Light Rail Transit, the international airport and industrial zone development (The state of Addis Ababa, 2017). The existence of international large and medium-size enterprises in and around Addis Ababa have also significant role in creating huge opportunity for employment and technology transfer. Furthermore, there are strong demand for goods and services following the existence of many embassies and inter-governmental organizations like the African Union and the United Nations Economic Commission for Africa.

Despite the fact that 86% of the industries in the city are micro and small scale (cottage and handicrafts, and small-scale), the majority of the country's large and medium scale industries are found in the city. Noticeable increases are also registered currently in other aspects of industrial growth.

The service sector is both the largest contributor to the city's economy and the largest employer. It contributes to 76.4% of the city's GDP while industry's share makes up (almost all) the rest. This sector is dominated by three major sub-sectors: Transport and communication; Real estate, Renting

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and Business services; and Trade, Hotel and Restaurants. According to the state of Ethiopian Cities 2015 report, the service sector has also been responsible for more than 50% of the growth in the estimated annual growth of the city's GDP. Although 75% of employment in the city is generated in the service sector, a large proportion of the employed work in low skill and low paying jobs as shop salespersons, petty and 'gullit' traders, sales workers in small shops, domestic helpers or doorkeepers and restaurant service workers.

Analysis of the economic structure of Addis Ababa reveals that the services sectors (63%) dominates while industry (36%) is in second place. It indicates that these sectors account for almost all of the Addis Ababa's GDP (The State of Addis Ababa, 2017).

Addis Ababa has a great share in the economy of the country due to its attractiveness to businesses, companies, individuals and foreign direct investment. Overall primacy index of the city is 24.8 based on urban employment and unemployment survey (CSA 2015). According to the State of Addis Ababa 2017 report, the simultaneous high rates of economic growth and urbanization in Addis Ababa indicates a likely further rising dominance of the city in Ethiopia's economy as well as growing agglomeration of economic activities in and around the city.

1.5. Why is it beneficial to invest in Addis Ababa?

Addis Ababa is the largest and most economically significant city in the country. Ethiopia's urban population share is only 17 percent (as of 2012, World Bank 2015). The city is the only urban area in Ethiopia capable of delivering scale economies in terms of concentrated demand, specialization, diversity and depth of skills, innovation, and technology transfers. Thus, investors will be benefited in getting capable human power from the market.

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The capital is the country's main industrial hub. The city dominates industrial capacity in almost all the branches of light manufacturing that Ethiopia prioritizes. As a result Addis Ababa completely dominates production in various subsectors. This can be taken as the political and social stability of the city.

Overall, the city has a beautiful environment, favorable location, and strong industrial base. Its advantage as an economic powerhouse of the country and human resource center are the most attractive features for local and overseas investors.

Moreover, investors will be getting a comprehensive set of incentives for priority sectors. These include:

- Customs duty free privilege on capital goods and construction materials, and on spare parts whose value is not greater than 15% of the imported capital goods' total value.
- Investors have the right to redeem a refund of customs duty paid on inputs (raw materials and components) when buying capital goods or construction materials from local manufacturing industries.
- Income tax exemption of up to 6 years for manufacturing and agro-processing, and up to 9 years for agricultural investment.
- Additional 2-4 years income tax exemption for exporting investors located within industrial parks and 10-15 years exemption for industrial park developers.
- Loss Carry forward for half of the tax holiday period. Several export incentives, including Duty Draw-Back, Voucher, Bonded Factory, and Manufacturing Warehouse, and Export Credit Guarantee schemes.

1.5.1. The city benefit from the investment

The city will be benefited from investment. These are discussed below.

- **Employment opportunity**

Investment is expected to provide direct and indirect employment. These range from unskilled casual workers, semi-skilled and skilled employees.

- **Improving growth of the economy**

Through the use of locally available materials and exporting products, the investment contributes towards growth of the economy by contributing to the growth of domestic product. These eventually attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of local materials will be payable directly to the producers. In addition, domestic products save foreign exchange and exports also bring money to the country.

1.6. The Current Status of Datacenter services in Ethiopia

As in the introduction of digital technology to Ethiopia, the introduction of Datacenter service is also late and slow. However, datacenter service is currently well known and some private companies as well as the government are giving attention to the significance and the business opportunity of datacenters. The government owned telecom company has already started giving colocation service of datacenter from its own datacenter facilities. The private sector has also shown interest in the area. As mentioned above, according to the latest data sourced from the ministry of Trade and industry, there are around 20 registered private datacenter service providers in Ethiopia. None of them has started their production site to give service. A few of them has started building civil work.

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On the contrary, as discussed in the ‘Significance of datacenters’ section, there is a huge demand rising from both the private business and government organizations for datacenters. The existing and emerging banks need datacenters. The educational institutes, government organizations and ministerial offices that process large data or provide multiple digital services need datacenters to store, process, avail and protect their information. The same need is there for business companies.

In the context of Ethiopia, the gap between the available datacenter services and the rising demand is huge. Either each institute has to build its own datacenter with all the required functional and security facilities, even though it means for a single or to racks or there must be another entity focused on building datacenters and renting according to the demands of the businesses. Only Ethio-Telecom is giving such service for few businesses.

While the primary need for the datacenter location is sufficient electric power supply and the availability of high bandwidth Internet service, Addis Ababa is well fitting city for both. It is also a common destination place for the required devices to be imported.

This is an important opportunity to build datacenters in Ethiopia and rent. The existing service is almost inexistent while the demand is huge. That makes this business untapped one.

2. Marketing study

2.1. Market analysis summary

- The current drive and emphasis by the government on the digital Ethiopia.

The government of Ethiopia has a vision for digital Ethiopia by 2025. Following this objective, the government is mobilizing all resources for digitalizing, demanding ministerial offices for automation of their processes, inviting foreign tech companies to invest on digital information systems, opening its telecom share to foreign private companies, setting IT parks and many more. This dictates the direction of the business in the country and makes datacenter services mandatory.

- The demand by almost all sectors, all companies and organizations.

These days, all companies are getting dependent on data processing for the effective and efficient running of their businesses. The demand for more powerful centers of data storage, process and communication is rising, which is what datacenters provide. This touches almost every sector like financial, ICT, education, health, agriculture, military, governance and civil service.

- The globalization influence

Globalization is unavoidable. We adapt and live through. The world is getting more and digital and it has become dependent on thousands of big and small datacenters across the globe where much of these is located in USA. We are left with no alternative to interact with the rest of the world except digital. The cyber space is the stage to play best to survive in all aspects of a nation economic or militarily.

- Untapped opportunity on local market and possible expansions to other African countries

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As discussed previously, the datacenter market is untapped in Ethiopia. While it is definitive to succeed in datacenter service business in Ethiopia, it also has a prospect to expand to the neighboring countries in Africa.

2.2. Datacenter service Demand Projection

The demand for data center can be influenced by a number of factors. The global digitalization trend is the leading factor. Automation of the traditional manual process in every sector uses digital or computerized systems.

In the present context of Ethiopia, the government has already envisioned digital Ethiopia and requires automation of the manual systems and control of digital systems through datacenters. Much of the websites of organizations based in Ethiopia are hosted abroad. Newly opening banks are collocating their datacenters in Ethio-telecom. Only few have built their own datacenter. Many business organizations have their own major business process that they don't want to add the headache of building, running and maintaining their own datacenter. That is why datacenter collocation service is a huge market opportunity in the fast growing Ethiopia.

2.3. Demand-Supply gap

Currently, it is only Ethio-telecom, which is giving a datacenter collocation service. However, there are up to sixteen foreign companies which are locally registered for datacenter services and are in a pre-implementation state.

The list of the companies, as found in investment office, are listed in the following table.

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Table 1 Companies investing on Datacenter in Ethiopia

Name of Investor	Country of Origin
YONG ZNG	China
CENTURY COMPACT TRANSFORMER AND SWITCH GEAR MANUFACTURING PLC	China
GEEK ZONE DATA CENTER PLC	China
AMITOP ICT SOLUTIONS PLC	China
XDMT DATA CENTER PLC	USA/Canada
ASIC TECH DATA SOLUTION PLC	China
HEBEI XINLI ELECTRICAL EQUIPMENT CO LTD ETHIOPIAN BRANCH	China
SEEYOO CLOUD DATE PLC	China
ROCKLAND OVERSEAS OFF SHORE SAL ETHIOPIA BRANCH	Lebanon
Cgrate International proprietary limited (Ethiopia Branch)	South Africa
Scutix Ethiopia ICT PLC	Germany/Serbia
Raxio Data Center plc	Netherlands/USA
DESS INC ETHIOPIA BRANCH	USA
Huihao Chen	China
Redfox Solutions Group PLC	USA/Ethiopia
Wingu Africa Data Center plc	Britain/Mauritius

3. Technology and engineering

3.1. Technology

3.1.1. Datacenter collocation service process

Once the datacenter is established, variety of clients may request for collocation service or hosting their system. The two entities will agree and sign Service Level Agreement (SLA). Accordingly, the datacenter provides the facility while the client brings its own systems to the facility and fire on its systems. The datacenter facility comprises the space, racks, electric power, cooling, protecting, maintaining, monitoring and professional support. The client in turn pays for the service and gets support according to the SLA.

3.1.2. Environmental and social impact assessment of the project

Building Datacenter and running service has no significant environmental impact unlike material production projects that uses chemicals. However, the minor environmental and social impacts due to a datacenter project may occur in different forms. An Environmental and Social Impact Assessment (ESIA) has to be carried out to study the potential environmental and social impacts due to the data center. Potential environmental and social impacts due to the running of a datacenter on attributes like socio-economic have to be assessed as part of the ESIA study. Appropriate mitigation measures to help minimize/avoid impacts from the datacenter have to be recommended in the study. The measures include avoidance measures, mitigation measures and environmental enhancement measures.

3.1.3. Datacenter capacity

The service capacity of the plant in full capacity is hosting collocation service of 16 containments which is the optimal set up of building the data center to get good return on investment in a relatively short time. The production capacity is based on projected demand and realistic market share that could be captured. The production site is to run 24 hours/360 days. The data center capacity can be expanded to accommodate more racks for more clients. While there is overwhelming demand for datacenter service, it is projected to ever increase.

3.2. Engineering

3.2.1. Land, buildings and civil works

The required area (m^2) and construction cost for the production facilities that essential for the successful operation of the processing plant is shown in the following table 2. A total area required for the service center is $1,230 m^2$. . In order to estimate the land lease cost of the project profiles it is assumed that all the project will be located in different land level from level 1/1 to level 4/3, their current market lease price is from 39,073.31 birr per M^2 to 2,800.71 birr per M^2 respectively. Therefore, for the profile a land lease rate of birr 3,885 per M^2 have been taken, which is between the ranges.

The cost of construction of building should be appropriate to the size and expected profitability of business, costs of building generally differs by the type of construction materials used, the type of foundation, wall height and location. The current building cost for simple storage and processing room is from 10,000.00 Birr per m^2 to 25,000.00 Birr per m^2 . The total construction cost of buildings and civil works, at a rate of Birr 20,000 per m^2 is estimated at Birr 24.10 million. Therefore, the total cost of land lease and construction of buildings and civil works is estimated at Birr 28.87 million.

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The proposed plant layout comprises the following buildings and structures.

Table 2 Building costs

S/No	Descriptions	Total area in M ²	Estimated cost per square meter (in Birr)	Total estimated cost (in Birr)
1	Server Area	640	20,000.00	12,800,000.00
2	Network room	30	20,000.00	600,000.00
3	Power room	40	20,000.00	800,000.00
4	Fire Suppression room	20	20,000.00	400,000.00
5	NOC	25	20,000.00	500,000.00
6	SOC	25	20,000.00	500,000.00
7	Staging Area	20	20,000.00	400,000.00
8	Generator room	160	20,000.00	3,200,000.00
9	Outdoor unit	30	20,000.00	600,000.00
10	Tele room	20	20,000.00	400,000.00
11	Power station	20	20,000.00	400,000.00
121	Administration office	40	20,000.00	800,000.00
13	technical office	20	20,000.00	400,000.00
14	Toilet and shower	40	20,000.00	800,000.00
15	Parking	100	5,000.00	500,000.00
16	Fence	500M	2,000.00	1,000,000.00
	TOTAL	1230 M² and 500M		24,100,000.00

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Table 3 Land lease period in Addis Abeba

Sector of development activity	Period of lease	Down payment
Education, health, culture and sports	90	10%
Industry (manufacturing)	70	10%
commerce	60	10%
For urban agriculture	15	10%
For others	60	10%

Sources: - city government of Addis Abeba land development and management bureau

Table 4 Land lease floor price in Addis Abeba

S/No	Land level	Current land lease floor price per M ²	Current lease price per M ² (Market price)
1	1/1	2,213.25	39,073.31
2	1/2	2,165.47	36,825.73
3	1/3	1,900.19	34,578.15
4	¼	1,552.93	31,119.21
5	1/5	1,531.91	29,096.45
6	2/1	1327.39	27,073.71
7	2/2	1,221.18	25,050.96
8	2/3	1,191.17	23,028.21
9	2/4	1,074.39	21,005.46
10	2/5	1,027.84	18,982.71
11	3/1	994.71	16,959.96
12	3/2	960.21	14,937.21
13	3/3	927.84	12,914.46
14	¾	904.77	10,891.71
15	3/5	873.74	8,868.96
16	4/1	814.06	6,846.21
17	4/2	786.45	4,823.46
18	4/3	748.80	2,800.71

Sources: - city government of Addis Abeba land development and management bureau

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3.2.2. Machinery and equipment

The datacenter consists of Structural cabling systems, Rack and Aisle Containment system, cabling for electric, ground and signal, Power Panels, Fire suppression system, Access control system, Video Surveillance system, Display Systems, DCIMS & Environmental monitoring system, Decoration System for wall, ceiling and floor, Power Supply & Distribution System including Generator, AVR, UPS, STS, IT PDF, Distribution board for NOC & Telecom Room and Cooling system. Much of the materials will be imported.

Table 5 Lists of devices required for datacenter

No	Equipment Name	Unit of measure	Quantity
1	Decoration System	System set	1
2	UPS	System set	1
3	Power Panels	System set	1
4	IT PDF	System set	1
5	STS	System set	1
6	Distribution board for NOC and Telecom Room	System set	1
7	Cabling	Set	1
8	Cooling system	System set	1
9	DCIMS and Environmental monitoring system	System set	1
10	Display Systems	System set	1
11	Rack and Aisle Containment system	System set	1
12	Structural cabling systems	System set	1
13	Video Surveillance system	System set	1
14	Access control system	System set	1
15	Fire suppression system	System set	1
16	Display Systems	System set	1
17	Rack and Aisle Containment system	System set	1
18	Structural cabling systems	System set	1
19	Video Surveillance system	System set	1
20	Access control system	System set	1

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4. Organizational structure

The selection of structure of the envisaged project is made based on the existing common structure of datacenter service providers operating in several parts of the world, the capacity, complexity and technology mix of the site. Organizational structure principles such as specialization, coordination, and departmentalization are also considered for design of structure that best suits the envisaged project

4.1. Manpower Requirement and Estimated Annual manpower costs

The man power required for the datacenter and the estimated annual cost is presented in the following table

Table 6 Man power and estimated annual cost

No.	Description	Number	Monthly salary	Annual salary
1	Datacenter manager	1	30,000.00	360,000.00
2	Administration and finance manager	1	15,000.00	180,000.00
3	Technical manager	1	25,000.00	300,000.00
4	Secretary	1	5,000.00	60,000.00
5	Accountant	1	10,000.00	120,000.00
6	Mechanical Engineer	3	20,000.00	720,000.00
7	Electrical Engineer	3	20,000.00	720,000.00
8	Network and monitoring	3	20,000.00	720,000.00
10	Guard	4	4,000.00	192,000.00
11	Driver	1	5,000.00	60,000.00
12	Cleaners	2	4,000.00	96,000.00
Sub total		21		3,528,000.00

5. Financial Analysis

5.1. General

The financial analysis evaluation of Datacenter service project, are mainly consisted of capital investment as well as operating and maintenance costs. The capital investment costs include fixed investment costs (initial fixed investment and replacement costs) and working capital, while operating and maintenance costs comprise current expenses related to manpower cost, utility, repair and maintenance costs, spare parts, Overheads, Sales, interest and depreciation expenses.

The financial analysis and evaluation has been conducted taking assumptions:

1. It is assumed that about 70% of the total capital investment costs including the working capital requirement could be covered through development bank loans of short and long-term credits. The remaining balance 30% will be covered by equity capital contribution of the project owner.
2. Even though the project might secure loans under different term and conditions as well as from different financial sources, for the purpose of calculation of debt service scheduling, the current development bank of Ethiopia credit terms and conditions have been used. Consequently. It is assumed that the project will secure loan facility on the basis of 11.5 % annual interest rate.
3. Even though the estimated project production life is more 10 years, the financial analysis has been undertaken for a period interval covering the first 10 years only, during which time most of the capital assets are assumed to be depreciated, debts recovered and pay-back period accomplished.

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4. It is assumed that the project will be start up production activity at 70 % capacity. During years 2 & year 3 the projects is anticipated to gradually increase capacity utilization to reach 100% in year 4. Therefore, starting from year 4 the project will be operational at full capacity.
5. For the project under reference promotional, sales and distribution expenses have been estimated at 3% of the sales revenue.
6. Maintenance and spare parts costs are 1.5% of the fixed investment costs.
7. Furniture and fixture costs assumed to be 500,000.00

5.2. Initial Fixed investment costs

The initial fixed cost of establishing the datacenter is summarized in the following table

Table 7 Initial Fixed investment costs

S/No	Fixed investment type	Unit of measurement	Quantity	Unit price	Total Amount	Remarks
1	Land	Square meter	1,230	3,885birr/M ²	4,778,550.00	The period of land lease will be 70 years and 10% of the total lease amount will be paid in the first year
2	Buildings and civil works	Square meter	1,230	lump sum	24,100,000.00	
Sub total					28,878,550.00	
3	Devices and equipment (Considering 16 Containments)	set	1	Lump sum	579,360,676.63	The detail is given in a separate table below
4	Truck and vehicles	Pcs	2	Lump sum	6,000,000.00	
5	Furniture and fixture	Pcs			500,000.00	
SUB TOTAL					585,860,676.63	
Fixed capital investment costs					614,739,226.63	
8	pre-operational expenses				2,000,000.00	
9	Working capital				9,985,000.00	
TOTAL INVESTMENT COSTS					626,724,226.63	

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Table 8 Details of cost for Devices and Equipment

No.	Item	Price in USD (1 Containment)	Price in USD (4 Containments)	Price in USD (8 Containments)	Price in USD (16 Containments)	Price in USD (32 Containments)
1	Decoration System	170,511.86	170,511.86	170,511.86	170,511.86	170,511.86
2	Power Supply and Distribution System	205,477.07	205,477.07	410,954.14	821,908.28	1,643,816.56
3	UPS	166,659.06	166,659.06	333,318.12	666,636.24	1,333,272.48
4	Power Panels	26,793.21	107,172.84	214,345.68	428,691.36	857,382.72
5	IT PDE, STS and Distribution board for NOC and Telecom Room	29,952.58	29,952.58	59,905.16	119,810.32	239,620.64
6	Cabling	136,514.63	546,058.52	1,092,117.04	2,184,234.08	4,368,468.16
7	Cooling system	162,282.15	405,705.38	730,269.68	1,379,398.28	2,677,655.48
8	DCIMS and Environmental monitoring system	201,104.07	201,104.07	201,104.07	201,104.07	201,104.07
9	Display Systems	120,635.41	120,635.41	120,635.41	120,635.41	120,635.41
10	Rack and Aisle Containment system	212,742.11	850,968.44	1,701,936.88	3,403,873.76	6,807,747.52
11	Structural cabling systems	69,622.29	278,489.16	556,978.32	1,113,956.64	2,227,913.28
12	Video Surveillance system	24,746.20	24,746.20	24,746.20	24,746.20	24,746.20
13	Access control system	22,818.28	22,818.28	22,818.28	22,818.28	22,818.28
14	Fire suppression system	70,576.64	70,576.64	70,576.64	70,576.64	70,576.64
Total Price in USD		1,620,435.56	3,200,875.51	5,710,217.48	10,728,901.42	20,766,269.30
Total price in Birr (considering current exchange rate of 1 USD =54 birr)		87,503,520.46	172,847,277.49	308,351,743.87	579,360,676.63	1,121,378,542.15

PROJECT PROFILE ON DATACENTER SERVICE

	Constant price for a given datacenter
	Price is a multiple of number of containments
	Price is a multiple of a cluster of 4 containments
	Price is half constant and half multiple of number of containments

5.3. Working capital

Working capital is the financial means required for smooth operation and maintenance of a project. Mathematically, it is a difference between current assets and current liabilities. In the particular case of the project under consideration, the current assets comprise receivables, inventories (local and imported material inputs, spare parts, work in progress, and products ready for delivery) and cash in hand, while current liabilities comprise accounts payable to creditors. See Annex table 13 detail annual working capital calculation.

5.4. Project Financing

Fixed capital investment costs and working capital requirements are assumed to be financed by equity capital of the owner and through loans of short and long-term credits.

The company obtains loans under different terms and condition as well as from different sources, for the purpose of calculation of debt service scheduling the current development bank of Ethiopia credit terms and conditions have been used. Accordingly, it is assumed that the company will be able to obtain loan 70% of the total investment costs for construction of different buildings and for purchase of devices. The remaining balance that of the total investment costs will be expected to be covered by equity contribution of the project promoter.

PROJECT PROFILE ON DATACENTER SERVICE

5.5. Production costs

As it is depicted in Annex Table 12 major categories of the total production costs are assembled into the following cost elements.

5.5.1. Utilities

In estimating costs of utility expenses for operation and maintenance of the project, Costs of fuel, oil and lubricant, electricity and water consumptions have been taken in to consideration, the rates of which have been estimated on the basis of the proposed capacity utilization program of the project and at the current official charging rates. At full capacity operation the project will have the following utility expense per annum which amounts to Birr 11 million.

Table 9 Utilities of the datacenter “000”Birr

<u>Utility in "000" Birr</u>		Start-up			Full Capacity
		70%	80%	90%	
Capacity utilization		70%	80%	90%	100%
Project year		1	2	3	4
Item description	Unit of measurement				
Fuel					
Gasoline for service vehicle	50km*260days*47Birr/LIT*12km/Li	51	51	51	51
Gasoline for transport truck	100km*100days*47Birr/LIT*8km/Li	59	59	59	59
Sub-Total		110	110	110	110
Change of oil and lubricant	10% of the fuel consumption	11	11	11	11
Sub-Total		1,382	1,382	1,382	1,382
Electricity	365days*24 hrs*1120kw*0.9280Birr/kwh	6,374	7,284	8,195	9,105
Sub- Total		6373.5	7284	8194.5	9105
Water	365days*1m ³ /day*15 Birr/m ³	3.5	4	4.5	5
Sub –Total		3.5	4	4.5	5
Telecommunication					
Telephone	5 lines*500Birr/month/line+18Birr/line/month	31.08	31.08	31.08	31.08

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Mobile	5 lines*1,500 Birr/month/line + 18birr/month/line	91.08	91.08	91.08	91.08
Fax	1line*100Birr/month + 17 Birr/line/month	1.4	1.4	1.4	1.4
Internet	25,000Birr/month	300	300	300	300
Sub-Total		423.56	423.56	423.56	423.56
TOTAL		8,293	9,204	10,115	11,026

5.5.2. Over heads

In the expenses under this title have been included land and building taxes, buildings, vehicles as well as machinery and equipment insurance, vehicles annual inspection; postage, telephone and e-mail, stationery and office supplies; printing and copying; audit fee; cash indemnity etc. The overhead costs and divided in to direct overheads and administration overheads.

Table 10 Overhead costs

Direct Overhead “000”Birr		Year 1	Year 2	Year 3	Year 4
Annual land lease Payment		683	683	683	683
Insurance					
Building and Civil works	0.10%	24.10	24.10	24.10	24.10
Devices and Equipment	0.20%	1,158	1,158	1,158	1,158
Motor vehicle and Truck	1%	60	60	60	60
Vehicles annual inspection	1,000 Birr per annum per vehicle	2	2	2	2
Work cloth	Two times per annum per workers at 1,000 Birr	6	6	6	6
Cleaning and sanitation	An estimate of 300 Birr/day	78.00	78.00	78.00	78.00
Sub Total		2,011	2,011	2,011	2,011
Administration Overhead “000’ Birr					
Audit fee	40,000 Birr per annum	40.00	40.00	40.00	40.00
Office cleaning and sanitation	2,000 Birr per month	24.00	24.00	24.00	24.00
Stationery and office supplies	2,000 Birr per month	20.00	20.00	20.00	20.00
Printing and Copy	2,000 Birr per month	24.00	24.00	24.00	24.00
Sub Total		108.00	108.00	108.00	108.00
GRAND TOTAL		2,119	2,119	2,119	2,119

PROJECT PROFILE ON DATACENTER SERVICE

5.5.3. Financial costs

As it has been outlined earlier under” project Financing” the current Development Bank of Ethiopia credit terms and conditions for newly establishing projects have been used to compute the financial costs, estimated to be incurred in connection with that of the total investment costs assumed to be covered through loan financing. The amount of the loan capital to be obtained and the financial costs to be incurred thereof have been determined depending on the amount of fixed investment cost and pre-production expenses.

5.5.4. Depreciation

Table 11 Depreciation in Birr "000"

Period			Start-up			
			70 %	80 %	90 %	100 %
Capacity utilization			70 %	80 %	90 %	100 %
Project year			1	2	3	4
Item description	Original Value					
Structure and civil works	24,100,000.00	5% of original value	1,205	1,205	1,205	1,205
Machinery and equipment	579,360,677.00	15 % of original value	86,904	86,904	86,904	86,904
Motor vehicles and trucks	6,000,000.00	15% of original value	900	900	900	900
Office equipment and furniture	500,000.00	20 % of original value	100	100	100	100
Pre-production expenses	2,000,000.00	25% of original value	500	500	500	500
Total			89,609	89,609	89,609	89,609

5.6. Break Even point and ROI

5.6.1. Break Even point (BEP)

Three kinds of break-even point

- A. BEP Sales Revenue(BR)
- B. BEP production (Volume)
- C. BEP Percentage (%)

A. Break-even point(BEP) Sales

To determine BEP Annual Sales, multiply annual sales found in income statement by the annual fixed cost, and divided by Annual sales less Annual variable cost.

$$\text{BEP (sales)} = \frac{\text{Annual sales} \times \text{Annual fixed costs}}{\text{Annual sales} - \text{Annual variables costs}}$$

Annual sales = 192,000,000 Birr at 70% capacity

Unit selling price = 100,000 Birr/rack

$$\text{BEP (sales)} = \frac{\text{Annual sales} \times \text{Annual fixed costs}}{\text{Annual sales} - \text{Annual variables costs}} = \frac{192,000,000 \times 145,707,000}{192,000,000 - 21,546,000}$$

$$\text{BEP (Sales)} = \underline{164,124,890 \text{ Birr}}$$

B. BEP production

To determine BEP production volume, divided BEP sales by the unit selling price (USP)

$$\text{BEP production} = 145,730,362 / 1,200,000 = 136.77 \text{ rack per year}$$

$$\begin{aligned} \text{c. BEP percentage} &= \frac{\text{Annual fixed costs} \times 100\%}{\text{Annual sales} - \text{Annual variables costs}} \\ &= \frac{145,707,000 \times 100\%}{192,000,000 - 21,546,000} \\ &= 85\% \end{aligned}$$

5.6.2. Return on investment

Return on investment = Net profit /Total capital requirement

$$= 98,342,000/626,724,226$$

$$= 16\%$$

The return on owners' investment (ROOI)

= Annual net profit /owners' investment

$$= 98,342,000/188,017,267$$

$$= 52\%$$

5.7. Project benefits

For financial analysis and evaluation of the given project, the least price of colocation given by Ethio tele-come and the number of available racks in all containments has been taken as a basis. Consequently, based on the recent market survey, the service is estimated at Birr 100,000 birr per rack per month.

As it has been stated earlier the project is envisaged to reach full capacity operation four years after commencement of production activities which are assumed to begin with 70% of the estimated total capacity.

Thus, according to the computation in Annex Table 15 and Annex Table 17, the net income and cash flow statements analysis revealed that at full capacity operation the project will generate a total income (gross revenue) amounting to 192 million Birr per annum. The Net Income Statement shows a steady growth of gross profit starting from (32.85) million Birr in year 1 reaching the peak of 151 million Birr in year 10. In its 10 years of manufacturing activities, the project is expected to generate

PROJECT PROFILE ON DATACENTER SERVICE

a total net profit of 374 million Birr and contribute 201.50 million Birr to the government treasury in form of 35% income tax.

According to the current investment Law, machinery and equipment are anticipated to be imported duty- free. The liquidity position of the project is very strong. The corresponding Annex Table 17 of “Cash Flow Statement” shows the positive cumulative cash balance of Birr 535 million and the project will not face any cash shortage throughout its production life.

The computation of the pay-back period as depicted in Annex table 20 indicates that the project will be able to reimburse itself from its net cash-income within seven years after commencement of production activities, the period which is considered to be very good for the project of this nature.

In Annex Table 23 of the Benefit-cost ratio and Net present value (NPV) have been calculated at 17% discount factor (D.F) for 10 years of the project activity. Accordingly, the project has NPV of 128 million Birr at 17%D.F. and the benefit-cost ratio of 1.18 at 17% D.F. These results are most appreciable, especially, when related to the external capital borrowing interest rate which ranges from 8.50% to 18.5 % for newly establishing projects.

Break-even point (BEP) have been undertaken the project under study when implemented will have BEP at about 85% operation of the estimated full capacity

In addition to this, finally, summary of financial efficiency tests have been conducted in Annex table 21, Accordingly, all efficiency ratios indicated positive trends and consequently, it can be inferred that the project can operate in the frame work of free market mechanism on commercially and financially viable basis and is remunerative.

ANNEXES

NNEX II

CALCULATION OF ANNUAL PRODUCTION COSTS

Table 12 Annual total production costs''000''

Period	Start-up			Full capacity						
	70 %	80 %	90 %	100 %	100 %					
Project Year	1	2	3	4	5	6	7	8	9	10
Cost category										
I. Material inputs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II. Labor	3,528	3,528	3,528	3,528	3,528	3,528	3,528	3,528	3,528	3,528
III. Utility	8,293	9,204	10,115	11,026	11,026	11,026	11,026	11,026	11,026	11,026
IV. Repair and Maintenance and spare parts (1.5 % of fixed costs)	9,221	9,221	9,221	9,221	9,221	9,221	9,221	9,221	9,221	9,221
VI Direct overheads	2,011	2,011	2,011	2,011	2,011	2,011	2,011	2,011	2,011	2,011
A. Direct Production costs	23,053	23,964	24,875	25,786	25,786	25,786	25,786	25,786	25,786	25,786
VII. Administration over head	108	108	108	108	108	108	108	108	108	108
VIII. Marketing and Promotional expense 3 % of sales revenue	4,032	4,608	5,184	5,760	5,760	5,760	5,760	5,760	5,760	5,760
B. Operating costs	27,193	28,680	30,167	31,654	31,654	31,654	31,654	31,654	31,654	31,654
Interest	50,451	47,506	44,222	40,560	36,478	31,926	26,850	21,192	14,481	7,845
Depreciation	89,609	89,609	89,609	89,609	89,109	89,009	59,770	1,205	1,205	1,205
C. Total production costs	167,253	165,795	163,998	161,823	157,241	152,589	118,274	54,051	47,340	40,704

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ANNEX IV CALCULATION OF WORKING CAPITAL REQUIREMENTS

- I. Minimum requirement of current assets and liabilities
- A. Accounts receivable: 26 days at total production costs minus depreciation and interest
- B. Inventory
1. Material inputs: 26 days
 2. Spare parts : 90 days
 3. Work under process: two days at direct costs
 4. Product ready for delivery: 8 days at direct costs plus administration overheads
- C. Cash on hand : 360 days
- D. Accounts payable 26 days for material inputs and utilities

ii. Working capital requirement

Table 13 Calculation of working capital

Cost category	Minimum Days of coverage	Coeff-icent of turnover	Project year									
			Start up			Full capacity						
			1	2	3	4	5	6	7	8	9	10
I. Current asset												
A. A/R	26	10	2,719	2,868	3,017	3,165	3,165	3,165	3,165	3,165	3,165	3,165
B. Inventory												
1. Material inputs	26	10	0	0	0	0	0	0	0	0	0	0
2. Spare parts	90	4	2,305	2,305	2,305	2,305	2,305	2,305	2,305	2,305	2,305	2,305
3. Work under process	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Product ready for delivery	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Cash on hand	90	4	5,790	6,018	6,246	6,474	6,474	6,474	6,474	6,474	6,474	6,474
D. Current assets			10,814	11,191	11,568	11,944	11,944	11,944	11,944	11,944	11,944	11,944
II. Current liabilities			829	920	1,012	1,103	1,103	1,103	1,103	1,103	1,103	1,103
A. A/p	26	10										
III. Working capital												
A. Net working capital			9,985	10,271	10,556	10,841	10,841	10,841	10,841	10,841	10,841	10,841
B. Increasing in working capital			9,985	286	285	285	0	0	0	0	0	0

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ANNEX V

PROJECTED SALES REVENUE

Table 14 projected sales revenue '000'

Period		U/m	Quantity at full capacity	Unit price	Start up			Full capacity						
					70 %	80 %	90 %	100 %						
Item description	Product mix													
Project year					1	2	3	4	5	6	7	8	9	10
	Number of rack available for rent	Rack	160	1,200,000	134,400	153,600	172,800	192,000	192,000	192,000	192,000	192,000	192,000	192,000
GRAND TOTAL					134,400	153,600	172,800	192,000	192,000	192,000	192,000	192,000	192,000	192,000

PROJECT PROFILE ON DATACENTER SERVICE

ANNEX VI

PROJECTED NET INCOME STATEMENT

Table 15 Projected Net income statement "000"

Period	Start up			Full capacity						
	70 %	80 %	90 %	100 %						
Project year	1	2	3	4	5	6	7	8	9	10
Item description										
Product sales revenue	134,400	153,600	172,800	192,000	192,000	192,000	192,000	192,000	192,000	192,000
Less total production costs	167,253	165,795	163,998	161,823	157,241	152,589	118,274	54,051	47,340	40,704
Gross profit	-32,853	-12,195	8,802	30,177	34,759	39,411	73,726	137,949	144,660	151,296
Tax	(11,499)	(4,268)	3,081	10,562	12,166	13,794	25,804	48,282	50,631	52,954
Net profit	-21,354	-7,927	5,721	19,615	22,593	25,617	47,922	89,667	94,029	98,342
Accumulated undistributed profit	-21,354	-29,281	-	(3,945)	18,649	44,266	92,188	181,854	275,883	374,226

PROJECT PROFILE ON DATACENTER SERVICE

ANNEX VII DEBT SERVICE SCHEDULE AND COMPUTATION PAYMENT OF EQUAL ANNUAL INSTALLMENTS

Table 16 Debt services schedule and computation

Item description	Project year									
	1	2	3	4	5	6	7	8	9	10
A. Investment and working capital										
1. Investment										
2. Increment working capital										
Total										
B. Loan receipts and balances										
1. Loan receipts										
2. Outstanding balance at end of year	438,707									
a. First year loan	438,707	413,096	384,541	352,701	317,200	277,616	233,480	184,268	129,397	68,216
Total										
A. Debt service										
1. First year Loan										
a. Interest	50,451	47,506	44,222	40,560	36,478	31,926	26,850	21,192	14,481	7,845
b. Repayment of principal	25,610	28,555	31,840	35,501	39,583	44,135	49,211	54,870	61,181	68,216

PROJECT PROFILE ON DATACENTER SERVICE

ANNEX VIII CASH-FLOW STATEMENT FOR FINANCIAL PLANING

Table 17 Projected Cash flow statement

Period	Start up				Full capacity						
	70%	80%	90%	100%							
Capacity utilization											
Project year	1	2	3	4	5	6	7	8	9	10	
Item description											
A. Cash – inflow	761,953	153,977	173,177	192,377	192,000	192,000	192,000	192,000	192,000	192,000	
1. Financial resource (total)	627,553	377	377	377							
2. Sales revenue	134,400	153,600	172,800	192,000	192,000	192,000	192,000	192,000	192,000	192,000	
B. Cash – outflow	719,308	100,850	109,687	118,654	119,881	121,509	133,519	155,998	157,947	160,669	
1. Total assets schedule including replacement	627,553	377	377	377							
2. Operating costs	27,193	28,680	30,167	31,654	31,654	31,654	31,654	31,654	31,654	31,654	
3. Debt service (total)											
a. Interest	50,451	47,506	44,222	40,560	36,478	31,926	26,850	21,192	14,481	7,845	
b. Repayment	25,610	28,555	31,840	35,501	39,583	44,135	49,211	54,870	61,181	68,216	
4. Tax	(11,499)	(4,268)	3,081	10,562	12,166	13,794	25,804	48,282	50,631	52,954	
C. Surplus (Deficit)	42,645	53,127	63,490	73,723	72,119	70,491	58,481	36,002	34,053	31,331	
D. Cumulative cash balance	42,645	95,772	159,262	232,985	305,104	375,595	434,076	470,078	504,131	535,462	

PROJECT PROFILE ON DATACENTER SERVICE

ANNEX XII TOTAL INVESTMENT COSTS

Table 18 Total investment costs”000”

Period	Start up			Full capacity								
	1	2	3	4	5	6	7	8	9	10		11
Project year												
Investment Category												
1. Fixed investment costs												
a. Initial fixed investment costs	614,739											
b. Replacement												
2. Pre-operational capital expenditure	2,000											
3. Working capital increase	9,985	286	286	286								
Total investment costs	626,724	286	286	286								

ANNEX XIII TOTAL ASSETS

Table 19 Total Assets

Period	Start up			Full capacity									
	1	2	3	4	5	6	7	8	9	10	11		12
Project year													
Investment Category													
1. Fixed investment costs													
c. Initial fixed investment costs	614,739												
❖ Cost of land													
d. Replacement													
2. Pre-operational capital expenditure	2,000												
3. Current assets increase	10,814	377	377	377									
Total assets	627,553	377	377	377									

PROJECT PROFILE ON DATACENTER SERVICE

ANNEX XIV SOURCES OF FINANCE

Table 20 Sources of finance

Period	Start up			Full capacity							
	1	2	3	4	5	6	7	8	9	10	Total
Sources of finance											
1. Equity capital	188,017	286	286	286							
2. Loan capital	438,707										
3. Current liabilities	829	91	92	91							
Total finance	627,553	377	377	377							

ANNEX XI SUMMARY OF FINANCIAL EFFECIENCY TESTS

Table 21 Summary of financial efficiency tests

Project year	Project year									
	1	2	3	4	5	6	7	8	9	10
Capacity utilization	70%	80%	90%	100%						
Financial ratio in %										
1. Gross profit : Revenue	-24%	-8%	5%	16%	18%	21%	38%	72%	75%	79%
2. Net profit : Revenue	-16%	-5%	3%	10%	12%	13%	25%	47%	49%	51%
3. Net profit : initial investment	-3%	-1%	1%	3%	4%	4%	8%	14%	15%	16%
4. Net profit : Equity	-11%	-4%	3%	10%	12%	14%	25%	47%	50%	52%
5. Gross profit : Initial investment	-5%	-2%	1%	5%	6%	6%	12%	22%	23%	24%
6. Operating costs : Revenue	20%	19%	17%	16%	16%	16%	16%	16%	16%	16%

PROJECT PROFILE ON DATACENTER SERVICE

ANNEX XV CALCULATIONS OF PAYBACK PERIOD

Table 22 Calculation of payback period”000”

Year	Amount Paid Back			Total investment	End of year
	Net Profit	Depreciation	Total		
1	(21,354)	89,609	68,255	626,724	-558,469
2	(7,927)	89,609	81,682	286	-477,073
3	5,721	89,609	95,330	286	-382,029
4	19,615	89,609	109,224	286	-273,091
5	22,593	89,109	111,702		-161,389
6	25,617	89,009	114,626		-46,763
7	47,922	59,770	107,692		+60,929

PROJECT PROFILE ON DATACENTER SERVICE

ANNEX XVI CALCULATIONS OF NET PRESENT VALUE AT 17% D.F.

Table 23 Calculation of NPV at 17% D.F.

Project year	Gross Revenue	1/(1+i) ⁿ At 17%	Present value at 17%	Project costs			
				Total investment	Operating costs	Total	Present value at 17%
1	134,400	0.854701	114,872	626,724	27,193	653,917	558,904
2	153,600	0.730514	112,207	286	28,680	28,966	21,160
3	172,800	0.624371	107,891	286	30,167	30,453	19,014
4	192,000	0.53365	102,461	286	31,654	31,940	17,045
5	192,000	0.456111	87,573		31,654	31,654	14,438
6	192,000	0.389839	74,849		31,654	31,654	12,340
7	192,000	0.333195	63,973		31,654	31,654	10,547
8	192,000	0.284782	54,678		31,654	31,654	9,014
9	192,000	0.243404	46,734		31,654	31,654	7,705
10	192,000	0.208037	39,943		31,654	31,654	6,585
Total			805,182				676,751

A. Benefit- cost ratio at 17% D.F. = 1.18

B. NPV at 17% D.F. = 128,431,000 Birr