176. PROFILE ON HIGH -TECH DIAGNOSTIC LABORATORY

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I. SUMMARY

This profile envisages the establishment of a high-tech diagnostic laboratory with a capacity of providing 200 different laboratory analyses per day. Diagnostic Laboratory is a place where research and testing is carried out such as blood, urine, stool test, x-ray, endoscope, Electrocardiography, biopsy etc. to find out the nature and types of diseases.

The market study shows that in Addis Ababa currently 2 high tech diagnostic laboratories are required. An additional three high tech diagnostic laboratories are required up to year 2025.

The total investment requirement is estimated at about Birr 24.95 million, out of which Birr 18.40 million is required for laboratory equipment. The service will create employment opportunities for 72 persons.

The project is financially viable with an internal rate of return (IRR) of 15.69% and a net present value (NPV) of Birr 6.80 million, discounted at 8.5%.

II. SERVICE DESCRIPTION

High-tech diagnostic laboratory testing service is essential to the basic management of patient care, allowing physicians to detect disease earlier, make diagnoses, prescribe therapies and monitor results. Although major progress has been made in diagnosing diseases that affect people living in affluent societies, diseases that annually kill millions in developing countries, tend to go undiagnosed.

There is an urgent and unmet need for more-accurate, cost-effective diagnostic technologies. To overcome these obstacles requires new or adapted diagnostic tools. These tools must be cost-effective and also affordable for public-sector programs.

In this profile, a high-tech diagnostic laboratory is considered, that would enable all healthcare providers serving populations, to determine the cause of a patient's affliction and make an informed decision about treatment.

III. MARKET STUDY AND SERVICE CAPACITY

A. MARKET STUDY

1. Past Supply and Current Demand

A medical laboratory or clinical laboratory is a laboratory where tests are done on clinical specimens in order to get information about the health of a patient. Laboratory tests are an integral part of the workup of any patient, and constitute up to 80% of a physician's diagnosis and treatment choice.

There are two main types of labs that process the majority of medical specimens. Hospital laboratories are attached to a hospital, and perform tests on patients. Private laboratories receive samples from general practitioners and other health clinics for analysis.

High tech diagnostic laboratories are specialized laboratories which provide technologically sophisticated testes such as;

- Magnetic Resonance Imaging (MRI)
- Upper Gastrointestinal Imaging (Upper GI)
- Voiding ystourethrogram (VCUG)
- Lumbar Puncture (Spinal Tap)
- Elecroencephalography (EEG)
- Electromyography (EMG)
- Biopsies

In Addis Ababa there is a shortage of high tech diagnostic laboratories. For example there is only one recently opened private laboratory that provides Magnetic Resonance Imaging (MRI).

The Ministry of Health does not yet have a standard for laboratories however, according to the Ministry one regional hospital should be available to serve a maximum of one million people.

Accordingly, assuming that the standard for regional hospital apply to high tech diagnostic laboratories and considering the current population size of the city (3.4 million) the total number of high tech diagnostic laboratories required is estimated to be 3. There is only one high tech diagnostic laboratory in the city which means an additional of 2 high tech diagnostic laboratories are required.

2. Projected Demand

Assuming that the population of the city grows at an average growth rate of 4% and applying the assumptions used to estimate present demand Table 3.1. shows the project demand for high tech diagnostic laboratories.

Table 3.1

DEMAND PROJECTION FOR HIGH TECH DIAGNOSTIC LABORATORIES

Year	Projected Demand	Annual Increment	Cumulative Increment
2009	3,536,000	136,000	
2010	3,677,440	141,440	277,440
2011	3,824,538	147,098	424,538
2012	3,977,519	152,982	577,519
2013	4,136,620	159,101	736,620
2014	4,302,085	165,465	902,085
2015	4,474,168	172,083	1,074,168
2016	4,653,135	178,967	1,253,135
2017	4,839,260	186,125	1,439,260
2018	5,032,831	193,570	1,632,831
2019	5,234,144	201,313	1,834,144
2020	5,443,510	209,366	2,043,510
2021	5,661,250	217,740	2,261,250
2022	5,887,700	226,450	2,487,700
2023	6,123,208	235,508	2,723,208
2024	6,368,136	244,928	2,968,136
2025	6,622,862	254,725	3,222,862

As can be seen from the above Table by the year 2025 the city requires an additional 3 high tech diagnostic laboratories.

3. Pricing

For the purpose of this study a price of Birr 75 per laboratory analysis is adopted

B. CAPACITY AND SERVICE PROVISION PROGRAMME

1. Capacity

Taking in to account the market study and based on the projected demand of the service and the economic level of service provision, the envisaged diagnostic laboratory will have a capacity of providing high-tech diagnostic laboratory services, of different types, to a total of 200 people per day on eight hours per shift and two shifts per day basis.

2. Service Provision Program

The provision of this type of service requires some years to penetrate into the market and capture a significant share. Therefore, the envisaged project will start providing services at 75% and 90% of its rated capacity in the first and second year of service provision, respectively. Full service provision shall be attained in the third year and then after.

Table 3.2

BUILD-UP PROGRAMME OF THE SERVICE OPERATION

Year	1	2	3-10
Capacity Utilization (%)	**75**	**90**	**100**
No. of people	54,750	65,700	73,000

IV. MATERIALS AND INPUTS

A. MATERIALS

The main materials and inputs required for the provision high-tech diagnostic laboratory services are laboratory chemicals and reagents, detergents, disposable hand gloves, disposable syringes, needles, clinical alcohol, cotton wick, toilet paper, plaster, body

ointments, dry cell and alkaline/ lithium batteries, film slides, ink and other miscellaneous consumables. The annual cost of these and other related materials are estimated to be of Birr 422,500.00 while the laboratory services reaches at its full capacity. (See Table 4.1).

Table 4.1

ANNUAL MATERIAL AND INPUTS REQUIRED AND ESTIMATED COST

Sr. No.	Description	COST(Birr)		
		LC	FC	TC
1	Disinfecting alcohol swabs, disposable, sterile	18,750	56,250	75,000
2	Examination gloves, disposable	12,500	37,500	50,000
3	Needle hub cutter, plastic	3,000	9,000	12,000
4	Syringes with automatic disabling feature after 2nd cycle, 5ml with 21Gx1.5" needle	6,750	20,250	27,000
5	Syringes 5ml, with by packed needle, disposable, sterile	8750	26250	35,000
6	Tuberculin syringes, 1ml, 3-part, with by packed needle, disposable, sterile	6,250	18,750	25,000
7	Alcohol lamp, metal, with screw cap, 60ml, complete with cotton wick	3,000	9,000	12,000
8	Diamond writer	3,750	11,250	15,000
9	Drying rack, for drying stained microscope slides Ethanol (ethyl alcohol) 96 % denatured	3,750	11,250	15,000
10	Filter paper	1,250	3,750	5,000
11	Forceps for microscope slides, 11.5cm, stainless steel	1,875	5,625	7,500
12	Fuchsine basic, biological stain powder	1,250	3,750	5,000
13	Halogen light bulb 20W 6V	1,875	5,625	7500
14	Immersion oil, synthetic, for use in tropical climates	1,700	5,100	6,800
15	Lens paper	1,125	3,375	4,500
16	Methanol 99.5% DG code: UN1230, class 3.2 II	875	2,625	3,500
17	Methylated spirit	937.5	2,812.5	3,750
18	Methylene blue stain	975	2,925	3,900
19	Microscope slides, frosted end, cut edges, cellophanized	1,125	3,375	4,500
20	Mirror unit for microscope	7,500	22,500	30,000
21	Phenol detached crystals	1,187.5	3,562.5	4,750
22	Staining rack for use over laboratory sinks	1,000	3,000	4,000
23	Sulphuric acid 95-97 %	2,350	7,050	9,400

Sr. No.	Description	COST(Birr)		
		LC	FC	TC
24	Wire loop, nichrome 18/8 steel, internal diameter 2.5mm	1,700	5,100	6,800
25	Wire loop holder	1,400	4,200	5,600
26	Xylene, low in sulphur (xylol/dimethyl-benzene)	6,000	18,000	24,000
27	Batteries(assorted)	3,750	11,250	15,000
28	slides	1,250	3,750	5,000
	Total	**105,625**	**316,875**	**422,500**

B. UTILITIES

The major utilities requires by the center are electricity, fuel oil and water. The estimated annual requirement of utility at full capacity and the corresponding cost is given in Table 4.2.

Table 4.2

ANNUAL UTILITIES REQUIREMENT AND ESTIMATED COST

Sr. No.	Description	Unit of Measure	Qty.	Unit price (Birr)	Cost ('000 Birr)
1	Electricity	kWh	100,000	0.4736	47.36
2	Fuel oil (stand by diesel generator)	lt	1000	6.90	6.90
3	Water	m^3	1000	3.25	3.25
	Total				**57.51**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Service Process

The high-tech diagnostic laboratory services are rendered to individual patients, hospitals, physicians, clinics, small diagnostic laboratories, bio medical research centers and other

related institutions. Services can also be given to private, governmental and non – governmental institutions on contractual basis.

The services are provided both at the laboratory center and at the premises of customers, as required. All diagnostic laboratory services related with medical imaging (like X-ray, CT-scanner, MRI and Ultrasound, etc) are provided within the laboratory center. The envisaged high-tech diagnostic laboratory center will provide various types of diagnostic services like:

- Anatomic pathology testing: The envisaged Diagnostic laboratory will provide full range of anatomic pathology testing. Microscopic tissue and cell examinations, such as biopsies and Pap tests are performed by skilled physicians and technologists, enabling the diagnosis of cancer and other diseases. Microscopic tissue and cell examinations, such as biopsies and Pap tests ,
- Malaria and Other water-born diseases,
- Genetics / Heritable Diseases: The envisaged Diagnostic laboratory will make maternal screening for birth defects and patient evaluation for inherited disorders
- Cardiovascular Disease: Cardiovascular Disease, still the nation's number one killer, is a major focus for the envisaged diagnostics laboratory. Traditional methods of assessing cardiovascular disease risk such as cholesterol,
- Endocrine System Disorders :Thyroid testing, answers on diabetes, bone disorders such as osteoporosis, infertility, pituitary disease, diseases of the adrenal glands, growth disorders and many metabolic disorders)
- Infectious Diseases: HIV, Hepatitis, and Influenza testing are but a few of the many services offered in the infectious disease laboratory. Viral load and genotyping tests for patients suffering from HIV and Hepatitis B and C are available. ICS Tests for STDs, Semi quantitative T-Cell Count Assay and Testing for resistant organisms as well as newly emerging strains of TB and other dangerous pathogens is also available).

- Toxicology: Toxicology can take on two distinct forms: drugs of abuse testing and therapeutic drug monitoring. In either case, the envisaged Diagnostics laboratory offers the most advanced methodologies available. The toxicology labs provide accurate and rapid results on blood lead and heavy metals. Additionally, toxicology testing is available to help monitor patients on long-term drug therapy to ensure they are receiving the proper amount of medication to control their disease without reaching dangerous levels in the blood, etc.

B. ENGINEERING

1. Laboratory Equipment

The list of machinery, equipment and other facilities required for provision of the high-tech diagnostic laboratory services is estimated to be Birr 18,408,000, out of which Birr 13,558,628 is in foreign currency .See Table 5.1.

Table 5.1

LABORATORY EQUIPMENT REQUIRED AND COST

Sr. No.	Description	UOM	Qty	COST(Birr)		
				LC	FC	TC
1	Ophthalmic Equipment(Assorted)	Lump sum		196,250	589,250	785,500
2	OR Equipment(Assorted)	Lump sum		125,000	375,000	500,000
3	Sterilization equipment	Lot	4	25,000	75,000	100,000
4	Electrocardiograph(ECG)	Set	1	20,000	60,000	80,000
5	X-ray machine	Set	1	55,125	165,375	220,500
6	CT-scanner	Set	1	875,000	2,625,000	3,500,000
7	Magnetic Resonance Imaging(MRI) scanner	Set	1	2,750,000	8,250,000	11,000,000
8	Ultrasound Equipment	Set	1	22,500	67,500	90,000

Sr. No.	Description	UOM	Qty	COST(Birr)		
				LC	FC	TC
9	Upper gastrointestinal imaging(Upper GI)	Set	1	23,625	70,878	94,500
10	Lumber Puncture(Spinal Tap)	Set	1	6,250	18,750	25,000
11	Voiding Ystourethrogram (VCUG)	Set	1	11,875	35625	47,500
12	Electromyography(EMG)	Set	1	16,250	48,750	65,000
13	Garbage kiln	Set	1	10,000	-	10,000
14	Laboratory equipment(Photometer, FACS Count, Chemistry analyzer, Hematology analyzer, Freezer, bio-safety cabinet, incubator, balance and centrifuge ,glass wares, microscope etc)	Lot	4	375,000	1,125,000	1,500,000
15	Vacuum cleaners and accessories(Assorted)	Set	4	40,000	-	40,000
16	Mobile diesel generator with canopy attachment and control system 11KW	set	1	17,500	52,500	70,000
17	TV-set	Set	2	24,000	-	24,000
18	Refrigerator	set	2	50,000	-	50,000
19	DVD player	Set	2	6,000	-	6,000
20	cafeteria facilities	set	1	200,000	-	200,000
	Total			**4,849,375**	**13,558,628**	**18,408,000**

2. Land, Building and Civil Works

The envisaged high-tech diagnostic laboratory services center requires a total built -up area of 500 m^2 which is used for administration offices, reception, examination and sample collecting rooms, tools and instrument store, toilet etc.

It is assumed that the envisaged project will rent the required space. Accordingly, at the rate of Birr 50 per m^2 / month the annual rental cost is estimated at Birr 300,000.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The total manpower requirement, including skilled and unskilled labor is 72 persons. The corresponding total labor cost, including fringe benefits, is estimate at Birr 715,500. Table 6.1 shows the list of manpower required and the estimated annual labor costs.

Table 6.1

MANPOWER REQUIREMENT & LABROUR COST

Sr. No.	Job Position	Req. No.	Salary (Birr)	
			Monthly	Annual
1.	General manager	1	4,000	48,000
2.	Snr .Secretary	1	1,000	12,000
3.	Head, finance & administration	1	3,500	42,000
4.	Snr. Lab technician	6	6,000	72,000
5.	Lab technician	4	2,800	33,600
6.	Medical equipment Operator	8	5,600	67,200
7.	Documentation attendant	2	1,000	12,000
8.	Receptionist	8	4,800	57,600
9.	Medical equipment technician	2	1,800	21,600
10.	Assistant medical equipment operator	4	2,000	24,000
11.	Sample collector	7	4,200	50,400
12.	Financial clerk	1	600	7,200
13.	Driver	2	1,100	13,200
14.	Cashers	7	1,200	14,400
15	Cleaners	6	2,400	28,800
16	Store keeper	2	1,100	13,200
17	Guard	7	3,500	42,000
18	Cafeteria Attendant	2	700	8,400
19	Gardener	1	400	4,800
	Total	**72**	**47,700**	**572,400**
	Workers benefit (25% of BS)	-	11,925	143,100
	Grand Total	**72**	**59,625.00**	**715,500.00**

B. TRAINING REQUIREMENT

Instructors and Technicians need to get local tailor made training and attachment training at similar centers. The cost of training is estimated at Birr 200,000 out of which 100,000 is with foreign currency.

VII. FINANCIAL ANALYSIS

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

Source of finance	30 % equity
	70 % loan
Bank interest	8.5%
Discount cash flow	8.5%
Accounts receivable	30 days
Material and inputs	30 days
Work in progress	1 days
Cash in hand	5 days
Accounts payable	30 days
Repair and maintenance	5% of laboratory equipment

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 24.95 million, of which 55% is required in foreign currency. The major breakdown of the total initial investment cost is shown in Table 7.1.

Table 7.1

INITIAL INVESTMENT COST

Sr. No.	Cost Items	Local Cost	Foreign Cost	Total Cost
1	Land lease value	-	-	-
2	Building and Civil Work	-	-	-
3	Laboratory Equipment	4,849.4	13,558.63	18,408.01
4	Office Furniture and Equipment	4849.38	-	4,849.38
5	Vehicle	100.00	-	100.00
6	Pre-production Expenditure*	1,377.59	100.0	1,477.59
7	Working Capital	121.29	-	121.29
	Total Investment cost	**11,297.64**	**13,658.63**	**24,956.27**

** N.B Pre-production expenditure includes interest during grace period (Birr 1.17 million) , training (Birr 200 thousand) and Birr 100 thousand costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

B. OPERATION COST

The annual operation cost at full capacity is estimated at Birr 5.35 million (see Table 7.2). The major components of the operation cost are depreciation, financial cost and repair and maintenance which account for 37.35%, 17.54 % and 17.18% respectively. The remaining 27.92 % is the share of material and inputs, direct labour, utility, labour over head, working premise rental and other administration cost.

Table 7.2

ANNUAL OPERATION COST AT FULL CAPACITY ('000 BIRR)

Items	Cost	%
Material and inputs	422.50	7.89
Utilities	57.51	1.07
Maintenance and repair	920.40	17.18
Labour direct	343.44	6.41
Labour overheads	143.10	2.67
Administration costs	228.96	4.27
Working premise rental	300.00	5.60
Total Operating Costs	**2,415.91**	45.11
Depreciation	2,000.80	37.35
Cost of finance	939.47	17.54
Total Production Cost	**5,356.18**	**100**

C. FINANCIAL EVALUATION

1. Profitability

Based on the projected profit and loss statement, the project will generate a profit through out its operation life. Annual net profit after tax will grow from Birr 60.89 thousand to Birr 1.42 million during the life of the project. Moreover, at the end of the project life the accumulated cash flow amounts to Birr 18.52 million.

2. Ratios

In financial analysis financial ratios and efficiency ratios are used as an index or yardstick for evaluating the financial position of a firm. It is also an indicator for the strength and weakness of the firm or a project. Using the year-end balance sheet figures and other relevant data, the most important ratios such as return on sales which is computed by

dividing net income by revenue, return on assets (operating income divided by assets), return on equity (net profit divided by equity) and return on total investment (net profit plus interest divided by total investment) has been carried out over the period of the project life and all the results are found to be satisfactory.

3. 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 of the project including cost of finance when it starts to operate at full capacity (year 3) is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 47\ \%$$

4. Payback Period

The pay back period, also called pay – off period is defined as the period required to recover 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.

5. Internal Rate of Return

The internal rate of return (IRR) is the annualized effective compounded return rate that can be earned on the invested capital, i.e., the yield on the investment. Put another way, the internal rate of return for an investment is the discount rate that makes the net present value of the investment's income stream total to zero. It is an indicator of the efficiency or quality of an investment. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments or putting the money

in a bank account. Accordingly, the IRR of this porject is computed to be 15.69 % indicating the vaiability of the project.

6. Net Present Value

Net present value (NPV) is defined as the total present (discounted) value of a time series of cash flows. NPV aggregates cash flows that occur during different periods of time during the life of a project in to a common measuring unit i.e. present value. It is a standard method for using the time value of money to appraise long-term projects. NPV is an indicator of how much value an investment or project adds to the capital invested. In principal a project is accepted if the NPV is non-negative.

Accordingly, the net present value of the project at 8.5% discount rate is found to be Birr 6.80 million which is acceptable.

D. ECONOMIC BENEFITS

The project can create employment for 72 persons. The project will generate Birr 4.52 million in terms of tax revenue. High-tech diagnostic laboratory testing service is essential to the basic management of patient care, allowing physicians to detect disease earlier, make diagnoses. Therefore, the project contributes to the wellbeing of the society.