Government of Ethiopia

SECOND INTERNATIONAL
AGRO-INDUSTRY
INVESTMENT FORUM

MINISTRY OF INDUSTRY

INVESTMENT OPPORTUNITIES
IN THE PLASTIC AND FLEXIBLE PACKAGING
MANUFACTURING SECTOR

EXECUTIVE SUMMARY

The report consists of market, technical and financial analyses components on the feasibility of an envisaged plant. The next section provides a synoptic summary of the findings under each component.

1.1 Analysis of the Business Environment

As per the analysis carried out by different institutions on the political, economic, socio-cultural and technological developments, Ethiopia offers a stable political and economic environment as well as security; exceptional climate; almost complete absence of routine corruption; continuously improving public service delivery which makes it potentially an ideal destination for investment. The macro economic performance in the past seven years has been very positive and the GTP indicates a very good prospect, with a minimum of 11% GDP growth per annum, for the future. Although the incentive packages that are currently given seem to be adequate, the government is planning to give additional incentives for the manufacturing sector, particularly to export oriented and import substituting projects. Priorities will be given to the manufacturing sector in support provision in the areas of licensing, land and finance allocation, and training.

The expansion of Universities as well as technical, vocational education and training (TVET) establishments in all parts of the country provides good opportunity in the supply of skilled and semi-skilled technical personnel. Health service provision and the development of infrastructure such as roads, energy and communication are also showing a rapid improvement in the country. The advancement of science and technology in the world and the spread of same in the country will favorably influence the smooth operation of the envisaged project.

To encourage investment a number of incentives are granted to investors which include: exemption of customs duty for importing capital goods and spare parts for investment and raw materials for production of export goods; income tax holidays; and the permission of losses to carry forward during tax holiday period. Ethiopia also provides different guarantees with respect to repatriation of capital, profit and against expropriation and nationalization. Accordingly, it can be concluded that Ethiopia is ideal for investment.

1.2 Market Study

1.2.1 Product Description and Application (Technology)

a) Flexible Plastic Packing Materials (Plastic Film and Sheet)

Generally, films less than 100µm thick are used to wrap products, to overwrap packaging (single packs, groups of packs, palletized loads), to make sachets, bags and pouches, and are combined with other plastics and other materials in laminates, which in turn are converted into packaging. Plastic sheets in thicknesses up to 200 µm are used to produce semi-rigid packaging such as pots, tubs and trays. The properties of plastic films and sheets are dependent on the plastic(s) used and the method of film manufacture together with any coating or lamination. In film and sheet manufacture, there are two distinct methods of processing the molten plastic which is extruded from the extruder die. In the cast film process, the molten plastic is extruded through a straight slot die onto a cooled cylinder, known as the chill roll.

b) Rigid Plastic Packaging Materials

Bottles are made by extrusion blow moulding. A thick tube of plastic is extruded into a bottle mould which closes around the tube, resulting in the characteristic jointed seal at the base of the container. Air pressure is then used to force the plastic into the shape of the mould. After cooling, the mould is opened and the item removed. It is possible to apply co extrusion to extrusion blow moulding so that multilayered plastic containers can be made by layering various plastics. An example would be where a high oxygen barrier, but moisture sensitive and this construction will provide for a 12 to 18 month shelf life for oxygen-sensitive products such as tomato ketchup, mayonnaise and sauces. A variation of injection and extrusion blow moulding is to stretch the pre-form after softening it at the second stage and then stretching it in the direction of the long axis using a rod and the stretched pre-form is then blow moulded which results in biaxial orientation of the polymer molecules, thereby increasing strength, clarity, gloss and gas barrier. Injection stretch blow moulding is used to make PET bottles for carbonated beverages. Screw cap and pressure fit closures with accurate profiles are made by injection moulding. Wide mouth tubs and boxes are also made by injection moulding. There are many food applications for rigid and semi-rigid thermoformed containers. Examples include a wide range of dairy products and yoghurts in single portion pots; fresh sandwich packs; compartmented trays to segregate assortments of chocolate confectionery; and trays for biscuits. Thermoforming can be combined with packing on in-line thermoform, fill and seal machines.

c) Laminated Plastic Packing Materials

Plastic films may be combined with other plastics by co-extrusion, blending, lamination and coating to achieve properties which the components could not provide alone. Co-extrusion is a process that combines layers of two or more plastics together at the point of extrusion.

Lamination is a process that combines two or more layers of plastics together with the use of adhesives and different plastic granules can be blended together prior to extrusion. Several types of coating processes are available to apply plastic coatings by extrusion, deposition from either solvent or aqueous mixtures or by vacuum deposition. Plastics are also used as coatings and in laminations with other materials such as regenerated cellulose film (RCF), aluminum foil, paper and paperboard to extend the range of properties.

1.2.2 Application

About 50% of Europe's food is packed in plastic packaging[1]. Plastic has properties of strength and toughness and specific plastics can meet the needs of a wide temperature range, from deep-frozen food processing (−40°C) and storage (−20°C) to the high temperatures of retort sterilization (121°C); and reheating of packaged food products by microwave (100°C) and radiant heat (200°C). Most packaging plastics are thermoplastic, which means that they can be repeatedly softened and melted when heated. Plastics are used in the packaging of food because they offer a wide range of appearance and performance properties which are derived from the inherent features of the individual plastic material and how it is processed and utilized.

The main reasons why plastics are used in food packaging are that they protect food from spoilage; can be integrated with food processing technology; do not interact with food; are relatively light in weight; are not prone to breakage; do not result in splintering; and are available in a wide range of packaging structures, shapes and designs which present food products cost effectively, conveniently and attractively. Plastics are used as containers, container components and flexible packaging and by weight; they are the second most widely used type of packaging and first in terms of value. Examples are as follows:

- Rigid plastic containers such as bottles, jars, pots, tubs and trays
- Flexible plastic films in the form of bags, sachets, pouches and heat lidding materials sealable flexible
- Plastics combined with paperboard in liquid packaging cartons
- Expanded or foamed plastic for uses where some form of insulation, rigidity and the ability to withstand compression is required
- Plastic lids and caps and the wadding used in such closures
- Diaphragms on plastic and glass jars to provide product protection and tamper evidence
- Plastic bands to provide external tamper evidence

[1] British Plastics Federation

- Pouring and dispensing devices
- To collate and group individual packs in multipacks, e.g. Hi-cone ring for cans of beer, trays for jars of sugar preserves etc.
- Plastic films used in cling, stretch and shrink wrapping
- Films used as labels for bottles and jars, as flat glued labels or heat shrinkable sleeves
- Components of coatings, adhesives and inks.

Plastics can be colored, printed, decorated or labeled in several ways, depending on the type of packaging concerned. Alternatively, some plastics are glass clear, and others have various levels of transparency; their surfaces can be glossy or matte. Plastics are also used to store and distribute food in bulk, in the form of drums, intermediate bulk containers (IBCs), crates, tote bins, fresh produce trays and plastic sacks, and are used for returnable pallets, as an alternative to wood. Some applications of plastics and flexible packaging include:

- Food Packaging
- Biscuit, bread and other packing –warp film
- Fresh fruit and vegetable packing-cutter box film
- Processed fruit and vegetable packing- case ready film
- Pasta and macaroni packing-film
- Snack food packing-food pouches and bags
- Beverage packaging
- Water packing-PET bottle
- Soft drink-PET bottles and soft drink pouches
- Juice packing-PET bottle and pouches
- Dairy product packaging
- Pouches
- Tubular films
- Drinking cups-souvenir drink cups, disposable cups, clear drink cups

1.2.3 Past Supply Trend

The local demand for flexible (plastic sheet and film) and rigid plastic packaging materials is met through both local production and import, while the demand for laminated plastic packing materials is entirely met through import. Accordingly, the major findings of the trends in past supply of plastic packing materials are summarized below.

a) Local Production

During the period 2001 to 2013, local production of plastic packing materials increased from 8,931 tons to 19,956 tons, registering an average annual growth rate of 8.44%. From 2009 to 2013, from the total local production of plastic packing materials, the majority is accounted by rigid plastic packaging materials (53.57%). The remaining 46.43% is accounted by flexible plastic packaging materials.

b) Import

1) Flexible Plastic Packing Materials

Import of flexible plastic packing materials which was 1,913 tons in 2001 has increased to 12,146 tons in 2013, registering an average annual growth rate of 8.44%. During the same period, the value of imported flexible plastic packing materials has increased from Birr 32.32 million to Birr 590.14 million, registering an average annual growth rate of 20.87%.

2) Rigid Plastic Packing Materials

From 2001 to 2013, import of rigid plastic packing materials exhibited significant growth. In 2002, import was only 73 tons and Birr 2.08 million in terms of volume and value, respectively. However, by 2013 imports had increased to 7,293 tons and Birr 342.59 million in terms of volume and value respectively.

From 2009 to 2013, in terms of volume, from the total import of rigid plastic packing materials the great majority (on average 75.74%) is accounted by bottle preforms, followed by boxes, cases, creates and similar articles (16.34%), stoppers, lids, caps and other closures of plastic (4.97%) and carboys, bottles, flasks and similar articles (2.95%).

3) Laminated Plastic Packing Materials

Ethiopia imports two types of laminated plastic packing materials: plastic laminated with paper; and aluminum foil. Import or total supply of laminated plastic packing materials during the period from 2001 to 2013 shows a noticeable increasing trend although there were fluctuations in some years. During the period 2001to 2006 the average import of laminated plastic packing materials was 169 tons. However, during the subsequent four years (2007--2010) imports increased to an average of 272 tons. Furthermore, from 2011to 2013 the import of laminated plastic packing materials escalated to an average of 423 tons. During the past 14 years, imports of the product increased by 26.62% annually. The amount of expenditure for importing laminated plastic packing materials has shown a huge growth during the period of 2001to 2013, increasing from Birr 2.60 million to Birr 35.77 million.

c) Total Supply or Apparent Consumption

1) Flexible Plastic Packing Materials

Total supply of flexible plastic packing materials, which was 6,059 tons in 2001, increased to 21,411 tons in 2013, registering an average annual growth rate of 16.97%. On average during the period under consideration (2001-2013) the share of local production was 46.70%, which implies that the majority (53.30%) of the local demand for flexible plastic packing materials is met through import.

2) Rigid Plastic Packing Materials

Total supply or apparent consumption of rigid plastic packing materials exhibits a year to year growth. The yearly average apparent consumption, which was about 4,600 tons during the period of 2001to 2003, has increased to a yearly average of about 17,300 tons during the period 2012 to 2013. During the period under consideration (2001-2013) total supply of rigid plastic packing material registered an average annual growth rate of 12.79%.

3) Laminated Plastic Packing Materials

Apparent consumption of laminated plastic packing materials increased from a yearly average of 106 tons in the years from 2001to 2006, to a yearly average of 423 tons during the period of 2011 to 2013, with a yearly average growth rate of 26.62%.

1.2.4 Present Effective Local Demand

In order to estimate the current effective local demand for plastic packing materials in Ethiopia, the following methods were applied:

- Double exponential smoothing (one parameter);
- Holte‟s two - parameter double exponential smoothing; and
- Time trend extrapolation

Based on the results of test statistics the time trend extrapolation method is found to be the most appropriate for all the products under consideration. Accordingly, the estimated present effective demand for each product is given below.

- Flexible plastic packing materials.………………. 21,903 ton
- Rigid plastic packing material…………………… 17,874 ton
- Laminated plastic packing material ……………… 507 ton

1.2.5 Trend in Factors that Affect the Local Demand for the Products under Consideration

The demand for plastic packing materials depends on the performance of the end users. Plastic packing materials are extensively used by food, beverage and chemical manufacturers. Moreover, the products are also used by other sub-sectors of the manufacturing sector such as textile, leather, and paper products as a primary protective packing material. Hence, past performance and future prospect of the manufacturing sector determines the magnitude of the demand for plastic packing materials. Accordingly, a thorough assessment of the manufacturing sector indicates that there is a progressively growing local demand for plastic packing materials.

1.2.6 Demand Projection

The local demand for flexible plastic packing materials is projected to increase from 24,562 tons in 2015 to 49,430 tons and 99,448 tons by the years 2020 and 2025 respectively. Moreover, by year 2030 the demand is projected to reach 200,052 tons. The local demand for rigid plastic packing materials is projected to increase from 19,077 tons in 2015 to 41,127 tons and 85,479 tons by the years 2020 and 2025 respectively. Moreover, by year 2030 demand is projected to reach 174,686 tons. Similarly, local demand for laminated plastic packing materials projected to increase from 594 tons in 2015 to 1,316 tons, 2,768 tons and 5,690 tons by the years 2020, 2025 and 2030, respectively.

1.2.7 Supply Demand Gap

The unsatisfied demand for flexible plastic packing material will increase from 14,834 tons in the year 2015 to 37,014 tons by the year 2020. Furthermore, the unsatisfied demand is projected to reach 85,759 tons and 186,363 tons by the year 2025 and 2030, respectively. Similarly, the unsatisfied demand for rigid plastic packing material will increase from 7,852 tons in the year 2015 to 26,802 tons by the year 2020. Furthermore, the unsatisfied demand is projected to reach 69,685 tons and 158,892 tons by the year 2025 and 2030, respectively. Since laminated plastic packing materials are entirely imported from abroad, the unsatisfied demand is equal to the projected demand. Accordingly, the unsatisfied demand is projected to increase from 594 tons in the year 2015 to 1,316 tons and 2,768 tons by the year 2020 and 2025, respectively. By the year 2030 the unsatisfied demand is forecasted to reach at 5,690 tons.

1.2.8 Market Share

The market share that could be captured by the envisage project is estimated by considering the unsatisfied demand, capacity of existing factories engaged in the production of similar items and competition from import. Accordingly the market share of the envisaged project for flexible plastic packing materials is projected to increase from 11,125 tons in 2015 to 27,760 tons and 64,319 tons by the years 2020 and 2025 respectively. Moreover, by year 2030 the market share is projected to reach 139,772 tons. The market share of the envisaged project for rigid plastic packing materials is projected to increase from 5,889 tons in 2015 to 20,101 tons, 52,264 tons and 119,169 tons by the years 2020, 2025 and 2030 respectively. Likewise, the market share of the envisaged project for laminated plastic packing materials is projected to increase from 445 tons in 2015 to 987 tons, 2,076 tons and 4,268 tons by the years 2020, 2025 and 2030, respectively.

1.2.9 Marketing Mix

A proper quality control system considerably minimizes waste or the rejection of end products and thereby avoids complaints by customers. It also reduces the envisaged factor's operating costs as it facilitates timely corrective measures. Accordingly, the quality control service of the envisaged plant requires a laboratory appropriate for conducting tests of raw materials and final products. Based on the data collected from end users the recommended factory gate price is shown below.

- Flexible plastic packing materials………………. Birr 53,200 per ton
- Rigid plastic packing material…………………….. Birr 55,300 per ton
- Laminated plastic packing material ……………….. Birr 72,950 per ton

For the envisaged project, its products are considered intermediate product and used for packaging various products manufactured by other industries. The end users are few in number and their geographical distribution is mainly in or around major cities and towns of the country. Accordingly, by taking the nature of the products and the characteristics of the end users, direct distribution to end users is selected as the most appropriate distribution channel.

The envisaged factory is recommended to aggressively advertise its product by distributing calendars, pamphlets as well as by participating in exhibitions and bazaars. Moreover, in a competitive market, trade promotion should be made to persuade or to make a product attractive for end users. The envisaged factory is recommended to offer discounts with the volume of product bought and credit for one to two weeks.

1.2.10 Product Mix

The type of flexible packaging films used for packaging food and beverages are BOPET Film, BOPP Film, LDPE Film, PVC Film and CPP Film. The envisaged plant should produce the above listed flexible packaging films to be laminated in combination with each other or with other substrates such as aluminum and paper followed by printing operation according to customer specification. Similarly for the rigid plastic containers the plastic containers used for beverage packing is mainly made of a plastic material known as PET and also plastic containers made of LDPE /HDPE plastic materials used for beverage and food packaging. Accordingly the envisaged plant will produce pre-form of plastic containers and bottles of different type as a finished final and to be blown to the final shape and size by the food and beverage packers.

1.2.11 Plant Capacity

The economic scale of the technology is assessed relative to the projected demand gap of both rigid and flexible packaging materials and it is found that for rigid plastic containers used for packaging, the economic scale of the technology is much lower than the demand gap projected and considering 300 days of operation, 3 shift operation, and 90 % of capacity utilization optimum capacity is recommended. For beverage containers/PET bottles/pre-form: annual capacity 3203.8 ton per annum and associated closures capacity of 269.42 ton per annum; plastic jars and containers with closures annual capacity 450 ton per annum and associated closures capacity of 60.75 ton per annum. From the above capacity breakdown the aggregated plant capacity of flexible plastic films of the envisaged plant will 47,061 ton per annum operating at full capacity considering five LDPE- and three PVC film-making lines to achieve and balance the output of BOPP, BOPET and CPP film production. However the projected demand gap of the flexible packaging materials as seen from the market study will reach 49,430 ton per annum to the envisaged plant capacity at the year of 2020.

Even though the demand gap is lower than the minimum plant capacity to produce the majority of flexible packaging materials to be used for the food and beverage packaging, all the flexible films types listed are recommended. The realization of the envisaged flexible film plant considers the industrial development strategy of the country, product mix, quality requirement of potential customers of the plant, flexibility of the production system, available technology in the world and skill requirement for operation and maintenance of machinery. Therefore, for the envisaged project, it is assumed annually 300 production days, 8 working hour per day, three shift operations, and capacity utilization rate of 90 %. The proposed capacity of the envisaged plant for the flexible plastic film is 47,061 ton per annum. It is envisaged that the plant will reach full capacity utilization at the fourth year of production after implementation period of two and half years.

1.2.12 Production Program

For the rigid plastic container production, the envisaged plant will operate at 75% capacity utilization rate at first, 85 % at second year of production and followed by the rich experience of technical, financial, marketing and sales factors of the environment, the envisaged plant will operate at full capacity utilization (100%) in the third year and thereafter. For the flexible film, the envisaged plant will operate at 65% capacity utilization rate during the first year, 75 % during second year and 85 % during the third year of production. When the market demand gap reaches equivalent level with the plant capacity and also building capability technical, financial, marketing and sales factors of the environment, the envisaged plant will operate at full capacity utilization (100%) in the fourth year and thereafter.

1.3 Technical Study

1.3.1 Raw Materials and Inputs

The raw materials and inputs required for the flexible and rigid plastic packaging material manufacturing process can be preliminarily categorized as direct and indirect raw materials, auxiliary materials and inputs and utilities. Accordingly the direct raw materials used for the rigid plastic packaging material manufacturing are PET, HDPE, LDPE, PP granules and coloring pigments. Similarly for that of flexible packaging BOPP Resin, BOPET Resin, CPP Resin, LDPE Resin, PVC Resin, additives, slip agent, anti-block and anti-static agents are used in different proportions according to the type of flexible packaging film required which in turn depends on the type of product to be packed. In addition, factory inputs and supplies for packaging, such as cardboard (carton) and polyethylene sheets, oil, grease and consumables are required and can be supplied from the local finished product market; however, the envisaged plant will produce the polyethylene sheet for its own packing for the delivery. The annual cost of direct raw materials for the envisaged plant at full capacity operation is estimated at about Birr **2,217,486,000**, out of which in 87 % is required in foreign currency. The annual cost of auxiliary materials, inputs and factory supplies for the envisaged plant at full capacity operation is estimated to be Birr **22,574,110** out of which 98 % is required in local currency. The annual utilities consumption for plant at full capacity operation is estimated to be Birr 80, 975, 380 in local currency.

1.3.2 Location, Site and Environment

Location: The potential market to the products of the envisaged plant is food and beverage producing plants, bottled water production plants, canned food production plants and other plants in various sectors that make use of flexible and rigid packaging materials for packing their products. To this end most of customers of the envisaged plant are food and beverage processing and packaging plants which are found mainly in and around Addis Ababa namely the communities of Sululta, Bisheftu, Dukam , Adama, Sebeta,Waleta, Gelan and Mojo. Since the raw materials and inputs are imported using land transportation the nearest potential source of raw material would be the Mojo dry port, which fortunately is located in close proximity to Addis Abeba and some other envisaged locations such as Bisheftu, Dukam, Adama, Gelan and Mojo.

Therefore, a potential location for the envisaged plant in this criterion could be the towns located nearby. Accordingly, Mojo, Adama, Bisheftu , Dukam and Gelan respectively could be identified as potential locations based on proximity to the source of raw materials. The industrial clustering program has identified cities and towns for industrial zone development for various industry types based on the resource potential, market potential for industrial products, availability of basic infrastructure, etc. The cities identified by the regional government clustering program are Lagatafo, Sebata, Sululta, Dukam,Galane, Bishoftu, Adama, Asella, Shashimane, Jimma and Nekemte. Based on this classification we shall consider the sites classified for a similar sector as packaging material production, food and beverage processing industries. Also industries that could serve as potential suppliers of raw materials for flexible packaging mainly plastic, paper and inks should be considered in the proposed locations. But from the data of Oromia clustering program potential locations for the envisaged flexible packaging manufacturing plant are proposed to be around Addis Ababa which should be near to the user (consumer) of the product. Accordingly, Adama, Sebeta, Sululta, Asella and Nekemte are identified as potential locations for the envisaged flexible packaging manufacturing plant due to the planned industrial clustering program as described below:

- **Adama town:** planned cluster comprising the following is present: agro-processing, packaging materials, paper and paper products manufacturing industries.

- **Sebata town:** planned cluster comprises textile and garment, high tech PVC, rubber and plastic manufacturing industries.
- **Sululta town:** planned cluster comprises pharmaceutical and medical equipment, candy food industry, wool textile, paper and paper products, animal feed, wood industry, essential oil and cosmetics industry.

The above towns are selected due to the clustering program. However Adama town is planned specifically for packaging materials industries. Moreover Sebeta, and Sululta are identified as industrial zones for paper and plastic production which may serve as potential raw material suppliers for the envisaged plant in the future. The development potential of the cities is expressed in terms of resource potential, suitable climate, presence/future plan of road network, market access for its products, etc. Based on the evaluation of the three proposed locations of the envisaged plant as indicated above, Adama town is found to be the best location for the envisaged flexible and plastic packaging plant followed by Sulelta and Sebeta equally the second alternative locations in equivalent rank.

Site: A site is a plot of land within the selected location sufficient and suitable for installation and operation of the plant. Accordingly the site of the envisaged project will be in one of the industrial zone in Adama town reserved for industrial zone clustering program considering the following major points such as lower land cost, sufficient space for future expansion of the plant availability of water and electricity, proximity to market access and raw material sources and adequate road access.

Environment impact: Generally the flexible and plastic packaging manufacturing plant discharges insignificant solid wastes, though far more liquid and gaseous wastes, namely:

Air Emissions: The expected air emission from the production process the envisaged flexible film and injected rigid container productoin plant are mainly the following:

- Greenhouse effect (CO2, CH4)
- Air acidification (SO2, NOX, HC1)
- Oxidizing photochemical pollution (hydrocarbons, CO, CH4

The emission rate is insignificant and the major sources are plastic granules warming/melting, additives (coloring pigments) paints and solvents, oil vapors, odors, gases from different operations. They could be mitigated through the installation of an effective ventilation system; workers should wear suitable masks when needed, sustainable maintenance for all machinery and continuous surveillance. Moreover from the printing operation and cleaning different parts of the printing facility solvents such as ethanol has been the most common additive used in fountain solutions and one of the main contributors to VOC emissions. Between 90% and 100% of used IPA is emitted to the air as fugitive emissions.

Solid waste: The solid wastes generated from the flexible and plastic packaging production unit are from cleaning of industry premises, gardens and packing materials, as well as some process scraps from the extrusion and injection operation These kinds of wastes are classified in to general waste category and they can be collected in a central collection or storage tank inside the premises of the company and can be sold to external or be recycled for different application and grades of plastic products.

Wastewater: In contrary to many other industries, the plastic industry does not consume much water. The majority of waste water in flexible packaging comes from the cooling of the machines, personnel daily household uses and cleaning. Moreover used fountain solution and waste water are often discharged to the sewage system when cleaning the dampening system. The waste water from cleaning can contain alkali, fungicides, and solvents. The nitrification inhibiting of damping solutions causes problems for water treatment plants that have this type of cleaning step for reducing the nitrification. All waste water will be collected and the water for the cooling will be recycled continuously and water from the cleaning and sanitation will be collected in sewage tanks once filled and disposed according to the acting municipality regulations. Handling waste water will prevent any seepage of bad water to the ground aquifer.

Noise pollution and mitigation plan: Noise pollution is one of the expected pollution types in metal packaging industry especially in the pressing unit. Noise pollution is expected to generate from machineries like injection, converting and workshop machinery. The noise protection for the manufacturing unit shall implement an effective hearing conservation program. If employee noise exposures are at or above an eight-hour, time-weighted average of 85 db every employee is expected to wear a hearing protection device. Generally it is recommended that in-built pollution prevention and appropriate waste management systems to be incorporated in the equipment of the plant. Investments on environmental technologies as well as environmental management system are recommended with the necessary operating and overhead costs to manage and comply with both national and international standards. The solid waste to be generated shall be properly collected, properly disposed to avoid any possible retrieval and finally either recycled or incinerated in a specially prepared incinerator while the liquid waste shall be collected and treated properly before discharge.

1.3.3 Technology and Engineering

The manufacturing technology for the flexible packaging involves production of the different plastic films followed by lamination either with substrates, namely paper or aluminum finished, with each other or with different combination depending on the product to be packed. According to the technology alternative review for the production of flexible films, recommended technology for the envisaged plant is:

- Linear Motor Simultaneous Stretching Technology: BOPET and BOPP films production,
- Casting technology: for CPP film production,
- Multi-layer blowing technology: LDPE film production,
- Film blown process: for the PVC film production

Moreover for the semi converting process such as printing and lamination the technology selected includes:

- Gravure printing
- Wet lamination

Similarly for the rigid plastic containers manufacturing technology for producing the complete rigid plastic bottle and cap packaging product involves technology of producing:

- Bottle pre-form through injection
- Bottle cap by compression moulding

The envisaged plant will supply the plastic bottle pre-form and caps as the final product However, the final shaping of the plastic container will be done by the packer.

Accordingly the investment costs of plant machinery and equipment is estimated to be Birr **1,790,670,370,** of which 87% is required in foreign currency. The investment costs of plant utility equipment, tools and devices is estimated to be Birr **119,809,960** out of which 87% is required in foreign currency. In addition, the investment cost of transportation facilities for material handling and public transport service is estimated to be Birr **20,290,000** and is required in local currency. Similarly, the cost of office furniture and equipment for the plant is Birr **1,223,000** and is required in local currency. The envisaged plant requires land for production halls to produce BOPP, PVC, LDPE, CPP, BOPET film production and for conversion, lamination and injection also for raw material storage, for finished goods storage, space for an administrative offices block, as well as for utilities including water reservoir, for power house, vehicular parking, internal roads and path ways, and green space. The space requirement of the plant is determined by the total area each production equipment occupy, adequate space required in between the equipment, space required for the workers and that needed to handle work in progress. Sufficient building space is also required to accommodate the storage of raw materials for three months of production. A finished product store will also have enough space to store a minimum of one month of finished products. Based on this the total area of the envisaged plastic factory is 46,200 m2 (4.62 hectare) with a length of 300 m and of 154 m width. Of the envisaged total area, the factory building area, including BOPP stretching block, conversion block, PVC, LDPE, CPP blowing block, BOPET stretching block and injection block all covers about 7,825 m2 or 16.9% of the total area. Office block covers about 417.6 m2 or 0.9 % of the total area.

The raw materials storage area and finished items storage area together cover about 1,200 m² or 2.6 % of the total area. The power house, utility house and guard house cover about 545.0 m2 or 1.18 %. Roads, parking areas for (staff vehicles & trucks) and, walk ways account for 15,200.00 m2 or 32.9 %. Open space accounts for 12,455.2 m² or 26.96 %. The greenery accounts 8,766 m² or 18.97. The site should also comprise internal roads to connect the different blocks of the plant and loading and unloading decks. Since this project is government-supported, we assume that the land for the project will be obtained at lower lease rate so that the cost reduction will have a significant figure on the viability of the project. In the same area cost of land is rated per meter square of Birr 11.00. Accordingly, assuming a land lease cost of Birr 11 per m² the total land lease cost is estimated at Birr 18, 972,800.00 of which 10 % of the total or Birr 1,897,280 will be paid in advance and the remaining balance will be paid in equal installments over 40 years. The cost of the construction works for the envisaged plant was calculated on the basis of the above proposed civil engineering preliminary design assumptions. The cost is calculated assuming that a square meter of construction with local material like hollow concrete block and concrete work on the current average market. Accordingly, the total estimated cost of building, civil work and infrastructures is estimated to be Birr 91,665,337.

1.3.4 Organization Structure and Human Resource

The envisaged plant operations and activities will be assigned to organizational units represented by managerial staff, supervisors and workforce to attain the objectives of the factory. The activities include planning, directing, coordinating and controlling of the factory operations at the required level of quality and specified time. The organization structure will be staffed with eligible personnel with the corresponding authority and responsibility for the achievement of the goals and objectives of the firm. The highest management body of the factory, the Board of Directors, is responsible for handling policy issues, approving strategic plans, and following-up the activities of the General Manager.

The General Manager is accountable to the Board of Directors. He is responsible for planning, executing, monitoring and controlling the whole operational activities of the company. There are four line departments and three services under the general manager. The line departments are: production and maintenance departments; commercial and property administration; administration and finance department; and marketing and sales department. The summary and the detail of a human resource plan of the envisaged plant are worked out based on the determined organization structure. Accordingly the total personnel requirement of the plant is estimated to be 222, skilled, semi-skilled and unskilled. The project will have employees with an initial total annual salary of Birr 9,490,000 when it commences operation. In addition, machine operators and quality supervisors need to be fully trained on the standard manufacturing practice and quality standard characteristics of the envisaged products. In view of this the number of trainees and the training type with the associated costs is estimated to be Birr 949,000.

1.3.5 Project Implementation

The project implementation schedule covers the activities starting from the project development and approval up to and including the trial-run and commissioning. It is envisaged that the program requires a total of 28 months starting from the project approval. Project implementation costs are pre-operation expenses which include costs of project management, detailed engineering of equipment and civil works, construction and commissioning, consultancy services, and personnel training. The project implementation cost that comprises cost of implementation is the sum of project follow-up and office running cost and design, construction and commissioning is estimated to be Birr 19,084,000.

1.4 Financial Analysis

The financial analysis of the project (benefits and costs) is computed over seventeen years assuming 24 months implementation period and 15 years of operation. In addition, depreciation and amortization, customs duty and income tax, repair and maintenance costs, terminal (salvage) values well as working capital have been worked out based on the existing laws of the country and standard assumptions. Accordingly, the major findings of the financial analyses are given below. The total investment cost of the project is estimated at Birr 2.633 billion. From the total investment cost, the highest share (Birr 2.023 billion or 76.84%) is accounted for by fixed investment cost followed by initial working capital (Birr 459.33 million or 17.44%) and pre operation cost (Birr 150.47 million or 5.71%). The total annual cost of production and revenue at 100% capacity utilization (year 5) is estimated at Birr 2.615 billion and Birr 3.006 billion respectively.

The project will generate a profit throughout its operation life. Annual net profit after tax increases from Birr 138.96 million to Birr 493.71 million. The projected cash flow of the envisaged project shows that the project would generate positive net cash flows throughout the operation years. Based on a 10% discount rate the internal rate of return and net present value are computed to be 21.85% and Birr 1.639 billion respectively, indicating the viability of the project.

The initial investment cost of the project will be fully recovered within six years. Other measures of profitability such as net profit as a percentage of sales revenue, net profit to equity and net profit to total investment are also attractive. The efficiency ratios like current assets to current liabilities and net cash flow to sales calculated from the balance sheet show that the project is highly liquid with sound financial performance. The breakeven point for sales and capacity utilization is computed at Birr 1.103 billion and 36%. Moreover, the sensitivity analysis carried out indicates that the project could be viable at adverse conditions (i.e. either a decrease of 18% in sales price or increase of 23% in production cost or an increase of 40% in investment cost). In addition to its financial viability, the project has a number of economic and social benefits. The establishment of the project has a foreign exchange saving effect on the economy through import substitution. Moreover, as a profitable venture it will contribute to the increase of regional and federal government revenue through corporate, payroll and other taxes. The project will create direct employment opportunities for about 222 persons. Furthermore, it creates a conducive environment for the rapid growth of service and trade sectors around the project site, which in turn create employment opportunity for a substantial number of persons. Moreover, the project will also create forward linkage with the manufacturing sector.