DETAILED FEASIBILITY ANALYSIS OF GAUZE, BANDAGES AND ABSORBENT COTTON

Part III

For

DEPARTMENT OF INDUSTRIES
MINISTRY OF ECONOMIC AFFAIRS
ROYAL GOVERNMENT OF BHUTAN

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CONTENTS

CHAPTER 1 - PROJECT AT A GLANCE

1. Project concept – Detailed feasibility analysis of **gauge, bandages and absorbent cotton**. The project envisages the manufacture of gauze, bandages and absorbent cotton mainly to meet the requirement of hospital supplies being procured by the Government of Bhutan.

2. Location - Phuentsholing, Thimphu, Paro, Gelephu, Punakha and Samdrup being the major towns constitute the main markets for gauze, bandage and absorbent cotton and have potential for setting up such a unit. However, keeping in view that all the raw materials viz gauze & bandage cloth and raw ginned cotton, etc which have high weight to volume ratio are required to be imported from India, the location of the unit near to Indian border would be quite logical with a view to reduce the unit cost of transport of raw materials. Further, a central location vis a vis major towns could be advantageous. Based on various other factors, these locations have been short listed in the order of preference as under.

Location	**Overall rating**
Phuentsholing	**49**
Thimphu	40
Paro	37
Gelephu	36
Punakha	35
Samdrup	35

3. Markets - Gauze, bandages and surgical cotton rolls are mainly procured centrally by Ministry of Health, Government of Bhutan for distribution to various hospitals in the country. Some quantities of bandages and surgical cotton is also imported by the private trade channels and marketed through medical stores in various cities of Bhutan. Based on the figures of government procurement, estimated sales by the medical stores, the size of the market is considered sufficient to absorb the production of a medium scale unit. The market is likely to further expand with the growth in the government procurement and open market demand. As the absorbent cotton finds many other applications besides medical application, the product has a good potential of sales through open market. As the government would be the major buyer, the unit has to focus on the products needed by the government hospitals in the initial phase. The unit could also explore the possibility of marketing their produce to neighboring markets in India.

4. Annual production capacity recommended	Absorbent cotton	–	300 metric tonnes
	Bandages assorted sizes	–	13.5 lac dozens
	Gauze rolls	–	1,20,000 rolls

5. Land and building requirement	Plot area	-	1500 sq. mts
	Built up area	-	300 sq mts
	Industrial shed	-	700 sq mts

6. Power requirement: 91 KWH

7. Main machinery:
High pressure kier
MMC revolving flat high production carding machine
Porcupine cleaner
Centrifugal hydro extractor
Wet cotton opener
Vertical opener
Two compartment continuous cotton dryer
Single soutcher and lap machine
Rolling and winding machine

8. Manpower requirement	Manager	–	1
	Manufacturing chemist	–	1
	Production supervisor	–	2
	Office staff & marketing executive	–	5
	Skilled workers	–	10
	Unskilled workers	–	7

9. Total project cost: Rs. 176.48 lacs

10. Project implementation period: 8-9 months

11. Means of finance	Debt	-	Rs. 123.54 lacs (70%)
	Equity	-	Rs. 52.95 lacs (30%)

12. Break up of cost of project	Machinery	-	Rs. 66.98 lacs
	Construction cost	-	Rs. 42.50 lacs
	Misc. fixed assets	-	Rs. 3.00 lacs
	Pre-operative exp.	-	Rs. 5.00 lacs
	Training expenses	-	Rs. 0.67 lacs
	Interest	-	Rs. 14.18 lacs
	Working capital	-	Rs. 44.16 lacs
	Total	**-**	**Rs. 176.48 lacs**
13. Annual sales turnover	Rs. 590 lacs		
14. Financial analysis	IRR – 34% on equity		
	IRR – 22% on investment		
	NPV – Rs. 100.39 lacs (discount rate of 12%)		
	Pay back period – 3 years 6 months		
	Project break-even – 60%		

CHAPTER 2 – JUSTIFICATION OF THE PROJECT

2.1 Project Concept

The project is for carrying out the detailed feasibility analysis for setting up a unit for the manufacture of absorbent cotton, gauze and bandages, mainly to cater to the government demand of hospital supplies.

2.2 Project Justification

Over the last four decades, the health care sector in Bhutan has undergone a radical change. Bhutan today has a well developed decentralized system of health care. The health care network of hospitals, Basic Health Units (BHUs) and Out Reach Clinics (ORCs) deliver free health care to over 90 per cent of nation's highly dispersed population. As of now, there are 29 hospitals, 176 basic health units (BHUs) and over 514 outreach clinics (ORCs) spread over 201 gewogs providing primary health care services. A total of 2,749 health personnel of different categories serve in different hospitals. Besides the allopathic system, there exists a well established network of indigenous medical facilities under the Institute of Traditional Medical Services that has basically three functions; medical services for out patients; collection and manufacturing of indigenous medicines.

In view of the growth in the health care facilities network, increase in the demand for various medicines and non-medicine items, upcoming industrial development of Bhutan, it has been realized that some of the requirements for hospital supplied could be manufactured in the country. This approach would provide higher level of efficiency and sustainability to health care services sector as well as help in the industrial development of the country. Based on the study of entire spectrum of hospital supplies viz. medicines and non-medicines items of supplies, their current level of demand, future demand projections, frequency of recurrence of the demand, major centres of requirement, present system of supplies, comparative advantages of factor inputs and markets, etc. It was found that there is enough justification for setting up a project for the manufacture of oral drug formulations in tablet and capsule form.

Surgical dressing or curator is a term applied to a wide range of materials used for the dressing of wounds**.** These materials are employed as coverings, absorbents protective, or supports for injured or diseased tissues. These materials used in surgery and in the treatment of wounds include the following.

- Surgical Cotton
- Surgical Gauze
- Bandages
- Medicated tapes

Besides these products, caps & masks and doctor aprons etc. commonly known as health care textiles are also widely used in hospitals. The selection of correct type of surgical dressing is a critical factor in safeguarding the welfare of patient undergoing surgery & treatment of wounds.

In case of Bhutan health care supplies, the surgical cotton, various sizes of bandages, gauges and medicated tapes constitute one of the major segments of hospital supplies. These items are being procured centrally by the Drug, Vaccine & Equipment Division, Ministry of Health, Government of Bhutan and then distributed to various hospitals and health care centres in the country as per their requirement. Presently there are no indigenous manufacturing facilities for the production of surgical dressings in Bhutan and entire requirement is being imported from India and other countries. Besides purchase of surgical dressings by Government for supply to hospitals, substantial quantity specially of surgical cotton is procured by private trade and marketed through medical stores. The household now a days specially in urban areas buy absorbent cotton, bandages and medicated tapes for emergency use and treatment and protection of minor injuries and cut wounds. Besides surgical dressings viz. cotton & bandage are extensively used for first aid boxes invariably kept in schools, Institutions, vehicles and even in houses. With the growth in urban population, improvement in medical facilities, increasing demand for first aid kits, the requirement of surgical dressings specially absorbent cotton and bandages is likely to increase at a very fast pace.

Keeping in view the increasing demand potential and the fact that there are no indigenous units in Bhutan manufacturing these products, the project has been designed for the production of surgical cotton, gauge & bandages to meet the domestic demand for hospital supplies, supplies to medical stores as well as some export to adjoining markets. The project envisages that for the manufacture of surgical cotton the raw cotton shall be imported and further processing be done in Bhutan. In case of gauze and bandages the project is proposed to implement in two phases. In the first phase the woven fabric shall be imported in raw form and further processing viz. bleaching, washing, sterilizing, cutting and packing shall be done by Bhutan unit. In the second phase the weaving looms for grey cotton cloth could be installed by the gauze bandage manufacturing unit and the starting raw material would be the cotton yarn.

The details of the various products, products range, quality specification and manufacturing process for various items of surgical dressings have been given the forthcoming chapters.

CHAPTER 3 – MARKET ANALYSIS

3.1 Demand and supply scenario

A wide range of products both medicines and non drug items are required as consumables in hospitals and basic health units. Majority of these items are procured centrally by department of medical services and then supplied to hospitals while other items are procured directly by hospitals. The list of consumable items required by hospitals particularly medicines is quite exhaustive and the demand level keeps on changing depending on the requirements and health programmes conducted by the government. However, certain items are consistently required in large quantities and constitute major portion of hospitals supplies in terms of consumables. Some of these items being procured centrally include the following:-

- Medicines mainly tablets
- Surgical cotton, gauge & bandages
- Disposable syringes
- Glucose saline
- Surgical gloves

The data relating to the procurement of gauze, bandages and surgical cotton which constitute the major supplies as available from Drugs, Vaccine & Equipment Division, Department of Medical Health Services is as given below:

Procurement Level of Surgical Cotton, Gauge, Bandages & Tapes

		2005-06			2006-07			2007-08		
Item	Unit	Unit Rate	Quantity	Total Amount	Unit Rate	Quantity	Total Amount	Unit Rate	Quantity	Total Amount
Surgical Cotton	Roll	35.4	22156	784322.40	32.4	26556	860414.40	34.62	26850	929547
Bandage 2.5cm	Doz	3.75	7500	28125.00	3.75	5592	20970.00	3.75	4539	17021.25
Bandage 5cm	Doz	7.15	18978	135692.70	7.15	13884	99270.60	7.15	18978	135692
Bandage 10cm	Doz	14.6	28000	408800.00	14.65	19837	290612.05	14.6	26839	391849
Bandage 15cm	Doz	21.5	25000	537500.00	21.55	17324	373332.20	21.5	19726	424109
Gauge	Than	37.85	35143	1330162.55	37.95	32558	1235576.10	37.85	37289	1411388
Medicated tape (Micro pore)	Roll	38.25	4491	171780.75	40.5	4302	174231.00	38.25	4364	166923
TOTAL				3396383.4			3054406.35			3476531

Gauze and bandages in various sizes and surgical cotton rolls are mainly procured centrally by Drugs, Vaccine and Equipment, Ministry of Health for distribution to various hospitals & basic health units all over Bhutan. Some quantity of bandages and surgical cotton is also imported by private trade channels and marketed through medical stores in various cities of Bhutan. Presently, the entire requirement, both for hospitals and medical stores is being met through imports as there is no indigenous production of these items in Bhutan. Besides medical applications, absorbent cotton finds many other applications and this product has a good potential for sales through medical stores. With the emerging scenario of health care sector in Bhutan, the demand for these items is likely to grow at a fast pace.

3.2 Competitive Advantages

In case of gauzes and bandages, it has been recommended that the unit could start with the grey fabric as their starting raw material in the first phase with a view to keep their investment low and also to have a flexibility to supply a wide range of quality fabric based bandages and gauzes. However, in the case of absorbent cotton, the entire manufacturing process has to be adopted starting from raw ginned cotton. The competitive advantage factors of the indigenous production over the imported products could be summarized as under: -

- Better inventory control management leading to lower cost of production, the production can be planned as per demand.
- The concerned agency / authority in the government could also minimize their inventory cost as the products could be procured at a short notice from the unit as per demand.
- Against the bulk order from the Ministry of Health, the possibilities of direct supplies of absorbent cotton, gauze and bandages by the unit to hospitals based on their demand could also be explored resulting in saving in the transport and the inventory and storage costs.
- The local production would also enable the medical stores to have better inventory control as they can procure these products as per their requirement.
- Quality control from raw materials to finished products and facility for strict compliance of the provisions of GMP.
- Direct purchase of raw materials viz raw ginned cotton and grey cloth at most competitive rates leading to lower input cost.
- Lower cost inputs in terms of power, transport and labour.
- Value addition leading to saving of foreign exchange.

Keeping in view these competitive advantage factors, it is envisaged that the unit would be able to capture a substantial market both in government supplies as well as in the open market sales.

3.3 Marketing Strategy

Like in the case of pharmaceutical formulation unit discussed in part II of the report earlier, it is quite relevant here to mention that in the current scenario, the government happens to be the major buyer of these products and the unit has to work in close co-ordination with the concerned authorities with a view to ensure that their products meet the quality standards

prescribed by the government and also that these are competitive in prices. As the indigenous requirement is relatively of low quantum, the unit need to vigorously explore the possibilities of export of their produce to neighboring markets. This would enable them to achieve the economics of production and be competitive in the market. In the existing scenario of market, the following marketing strategies need to be adopted by the unit: -

- Marketing of absorbent cotton and gauze and bandages to concerned department in Ministry of Health for onward distribution to hospitals specially in bulk packs.
- Marketing to hospitals as some of the hospitals are directly procuring these products.
- The unit needs to get its products approved as per relevant standard and specifications of the Ministry of Heath, Government of Bhutan.
- Sales to medical stores through medical / sales representatives.
- Export to adjoining markets in India and other countries.

3.4 Product range & target markets

Protective covering for wounds are called dressings. These are placed directly on to wounds and may be used to control bleeding, to absorb secretions or to prevent contamination by bacteria or foreign material such as dirt.

Dressings should be large enough to cover a wound completely. They should be sterile so that they do not introduce bacteria that could cause infection. A dressing should also be absorbent in order to prevent accumulation of sweat, otherwise the skin around the wound becomes moist and soft, thus encouraging infection. These are of various types, for example, adhesive bandages, which consist of absorbent pads held in place. They are commonly used to protect small wounds. Non stick dressings consist of a non adherent layer of perforated polyethylene or viscose with an impregnated gauge pad packing. Improvised dressings which are used in an emergency almost any clean dry, and absorbent materials may be used to cover wound.

The project has been designed for the manufacture of surgical bandages, gauge and surgical cotton. As these products are used in surgery for coverings and as absorbents in the treatment of wounds and support for injured or damaged tissues, these are required to meet the specific requirement of pharmacopoeia of the country of use viz. IP, BP or USP. As these products are related to human health, special care need to be taken in their manufacture. The project envisages the production following main products:-

- Surgical cotton Bandage

- Surgical cotton gauze

- Absorbent Cotton

Cotton Bandages & Cotton gauze:

Cotton bandages & cotton gauze fall under the category of primary wound dressings and are placed next to the wound surface and are usually reinforced by materials of various types to absorb the wound secretion and minimize maceration.

- Gauze compresses of suitable mesh and thickness have long been widely used as primary wound dressings, but they have the drawback of adherence to other than clean, incised wound surface. To minimize this difficulty, various types of dressings have been designed to avoid the pain and trauma caused when a dressing which is adhered to a wound surface is removed.

- Petrolatum impregnated gauze have been widely used for this purpose on the theory that since it possesses hydrophobic characteristics it should not adhere. However, this often does not prove to be the case and in addition this material very frequently causes maceration and is difficult to sterilize.

- In an effort to eliminate these problems, a special type of gauze, knitted from pure, regenerated cellulose and impregnated with bland, hydrophilic, oil in water emulsion in such a way that all pores remain open, has proved to have an extremely low degree of adherence to all types of wounds. It is known a sadistic Non-Adhering Dressing. Each dressing is packaged sterile in a unique envelope that guarantees sterility and, at the

same time, can be opened easily under sterile conditions.

- The weaves is tight enough so that buds of new skin can not grow through the dressing and become entangled in the filaments. The dressing has a sidewise stretch which allows conformability without wrinkling.

- The versatility of this dressing make it excellent for all types of wounds such as burns, skin grafts, colostomies, ileostomies, open ulcers, and cases where packing is needed.

- Another type of non-adhering dressing consists of an absorbent pad faced with a soft plastic film having openings. These are large enough to allow fluids to pass through, but too small to allow adhesion of the wound to take place. This dressing is available both in the form of pads of many sizes with various packing, including perforated adhesive tape. Still another nonadhering dressing consists of non-adherent coated, open structured, nonwoven facing fabric which is used over various absorbent filler materials.

- It is important to use a no adherent dressing next to any wound surface wherever possible, both as a matter of patient comfort and to minimize interference with sound healing when the dressing is removed.

Surgical Gauzes

The function of surgical gauze is to provide an absorbent material of sufficient tensile strength for surgical dressing. It is listed in the USP under Absorbent Gauze.

In the process of making surgical gauze, the raw cotton fiber is mechanically cleaned and then spun or twisted into a thread, and the thread, in turn, woven into an open-mesh cloth. This cloth is gray in appearance and nonabsorbent. It is bleached white and rendered absorbent by much the same processes as those used in the preparation of surgical cotton.

The gauze thus treated is dried by passing in a continuous length through a tentering machine. Tenterhooks straighten, stretch, and hold the gauze taut as it is dried. When it leaves this apparatus the dried gauze is cut into lengths, folded, rolled and packaged.

Gauze is classified according to its mesh or number of threads per inch. Some types of surgical dressing require close meshed gauze for extra strength and greater protection, while other uses such as primary wound dressings, absorbent secondary dressings, and larger dressings to absorb purulent matter or other drainage require softer, more absorbent gauzes, having a more open structure.

Various forms of pads, compresses, and dressings are made from surgical gauze, alone or in conjunction with absorbent cotton, tissue paper and other materials.

- Filmated Gauze is folded absorbent gauze with a thin, even film of cotton or rayon distributed oven each layer. This filmation fluffs up and give ample dressing volume, yet costs less than gauze alone of equivalent volume. It possesses quick absorption and unusual softness.
- Non Woven Surgical Sponges. During the past few decades non-woven fabrics have

been developed which are suitable alternatives to woven cotton gauze for use in wound cleaning, wound dressing, and tissue handling sponges. These non-woven fabrics depend on dense entanglement of their synthetic fibers (Dacron, Rayon etc) to provide the fabric with an acceptable tensile strength approaching that of woven cotton gauze. They typically offer greater absorbent capacity than cotton gauze sponges of comparable bulk while generating less lint.

- Antiseptic or medicated Surgical Gauze. Most commonly used is iiodoform gauze, which contains 5% iodoform and is largely used as a packing or drainage material.

- Selvage Edge Gauze Strips in widths of ¼ in to 2 in are specially designed and woven for use both as packing strips in surgery of the nose and sinuses, nasal homeostasis etc. and as drainage wicks in the treatment of boils, abscesses, fistulas, and other draining wounds.

- Gauze pads or Sponges are folded square of surgical gauze. These pads are so folded that no cut gauze edges or loose threads are exposed. This prevents loose fibers from entering the wound. The edges are so folded that each size may be unfolded to larger sizes without exposing cut edges or loose threads. Most popular sizes are:

  2 x 2 in – 12 ply
  3 x 3 in – 12 ply
  4 x 4 in – 8 ply
  4 x 4 in – 16 ply
  8 x 4 in – 12 ply
  8 x 4 in – 24 ply

- Sterilized packages of these frequently used all gauze sponges are available in tamper proof packages of 2's. Such sterile units are particularly well suited to the numerous tray sets prepared in hospitals.

- X-ray Detectable Gauze pads are similar to all gauze pads but contain inserts treated with barium sulfate. They are nontoxic, soft, and nonabrasive. They remain permanently detectable because they do not deteriorate is the body nor are they affected by either sterilization or time. Ray -Tec X-Ray Detectable Sponges contain a nonabrasive vinyl plastic monofilament which gives a characteristic pattern in the X-ray.

- Composite absorbent dressings have been developed for specific purposes. They usually consist of layers of absorbent gauze or nonwoven fabric with filler of cotton, rayon, nonwoven fabric, or tissue paper in suitable arrangements. Composite sponges have gauze or nonwoven fabric surfaces with filler of cotton, rayon, nonwoven fabric, or absorbent tissue.

Surgical Bandages

The function of bandages is to hold dressings in place to provide pressure or support. They may be inelastic, elastic, or become rigid after shaping for immobilization.

Common Gauze Roller Bandage is listed in the USP as a form in which Absorbent Gauze may be provided. It is prepared from Type 1 Absorbent Gauze is various widths and lengths. Each bandage is in one continuous piece, tightly rolled and substantially free from loose threads and raveling.

Muslin Bandage Rolls are made of heavier unbleached material (56 x 60 mesh). They are supplied in the same widths as the regular gauze bandage. Muslin bandages are very strong and are used wherever gauze bandages do not provide sufficient strength or support. They are frequently used to hold splints or bulky compression dressings in place.

Elastic bandages are made in several types:

- Woven Elastic bandage is made of heavy elastic webbing containing rubber threads. Good support and pressure are provided by this type of rubber elastic bandage.

- Crepe bandage is elastic, but contains no rubber. Its elasticity is due to a special weave that allows it to stretch to practically twice its length, even after repeated launderings. This elasticity make the crepe bandage specially serviceable in bandaging varicose veins, sprains etc., because it conforms closely to the skin or joint surfaces lies flat and secure, yet allows limited motion and stretches in case of swelling so that circulation is not impaired.

- Conforming Bandage is a new type of readily conforming bandage made from two plies of specially processed, high quality, 14 x 8 cotton gauze folded to the center. This type of bandage is must easier to use and apply than ordinary rolled bandage since it tends to cling to itself during application, thus preventing slipping. It readily conforms to all body contours without the necessity of "reversing" or twisting. A further advantage is the fact that can be no rough or frayed edge.

- High Bulk Bandage is made of multiple layers of typically 6 layers of crimped cotton gauze. The high bulk of this bandage type is designed to provide padding protection is wound dressing applications.

Triangular Bandages are usually made by cutting a square of bleached muslin diagonally from corner to corner, forming two right triangles of equal size and shape. The length of the base is approximately 54 in.

Orthopedic bandages are used to provide immobilization and support in treatment of broken bones and in certain condition of bones and joints. Plaster of Paris impregnated gauze has been the standard material for this purpose.

Surgical Cotton

Cotton is the basic surgical absorbent. It is an official USP listing under Purified Cotton.

The raw cotton fiber mechanically cleaned of dirt and carded into layers, but not otherwise treated, has a limited use for paddings and coverings of unbroken surfaces. This form is supplied under the name of nonabsorbent cotton. It is also frequently used as cotton plugs in

the bacteriological laboratory because of its non- absorbency.

Absorbent Cotton is prepared from the raw cotton fiber by a series of processes which remove the natural waxes and all impurities and foreign substances and render the fibers absorbent. Briefly summarized the processes may be described as follows. Each cotton bale goes through a mechanical cleaning process. Foreign matter, dust, seed hulls and soil etc. are removed by means of "openers": pickers" etc. From the mechanical cleaners, the cotton is blown through large pipes to the boiling kier and the bleaching tub where it is made absorbent and bleached. In these processes it is freed from the waxes, resins, fats and coloring matter normally present in the raw fiber.

During the chemical treatment, all surgical cotton is thoroughly washed using a fresh supply of water for each washing. A practically pure, white cellulose fiber is the result.

Cotton thus treated is dried by being passed, on a moving screen, through long drying ovens. The dried cotton is then ready for the: lapping: process. The beaters tear the tufts of cotton to smaller pieces. The grid bars eliminate the short fibers and foreign matter. The rollers press the cotton into a continuous lap in which form it passes through the carding machine. There, thousands of wire needles remove the short fibers and straighten out the longer cotton fibers, forming a thin web. This is the familiar roll cotton. Other cards fold the web which is then cut into uniform strips and automatically rolled into cotton balls.

Besides the familiar roll form, Purified cotton may be obtained in various prepared forms such as cotton balls, cotton tipped applicators, etc.

Cotton balls can be prepared by hand but they are more advantageously made on special machines. Machine made balls are firm, compact, and uniform in size, shape, and weight. They are produced in several sizes. The larger size balls are made for obstetrical uses in the delivery room, or when changing perineals pads. The medium cotton ball is particularly useful for applying antiseptics or medication locally, cleansing the skin and in the nursery where manifold uses are apparent. The small cotton ball is often used for skin cleansing before hypodermic or intravenous injections and in applying local medications to small areas.

Quality Standards and specifications

Bureau of Indian Standards (BIS) have specified standard specification for cotton gauze absorbent non sterilized and for cotton bandage cloth.

3.1 Cotton gauze absorbent non sterilized:

BIS standards prescribe the constructional particulars and other requirements for bleached, non medicated, absorbent and non sterilized cotton gauze as follows:

Yarn: the cotton yarn used in the manufacturing of gauze shall confirm to the requirement of IS-

171-1985, cotton & cotton regenerated fabric blended grey yarn.

Cloth: The cloth shall be woven in plain weave and bleached. The cloth shall be free from weaving defects, sizing, dressing & filling materials and substances liable to cause subsequent tendering the cloth shall confom to the requirements given in table below;

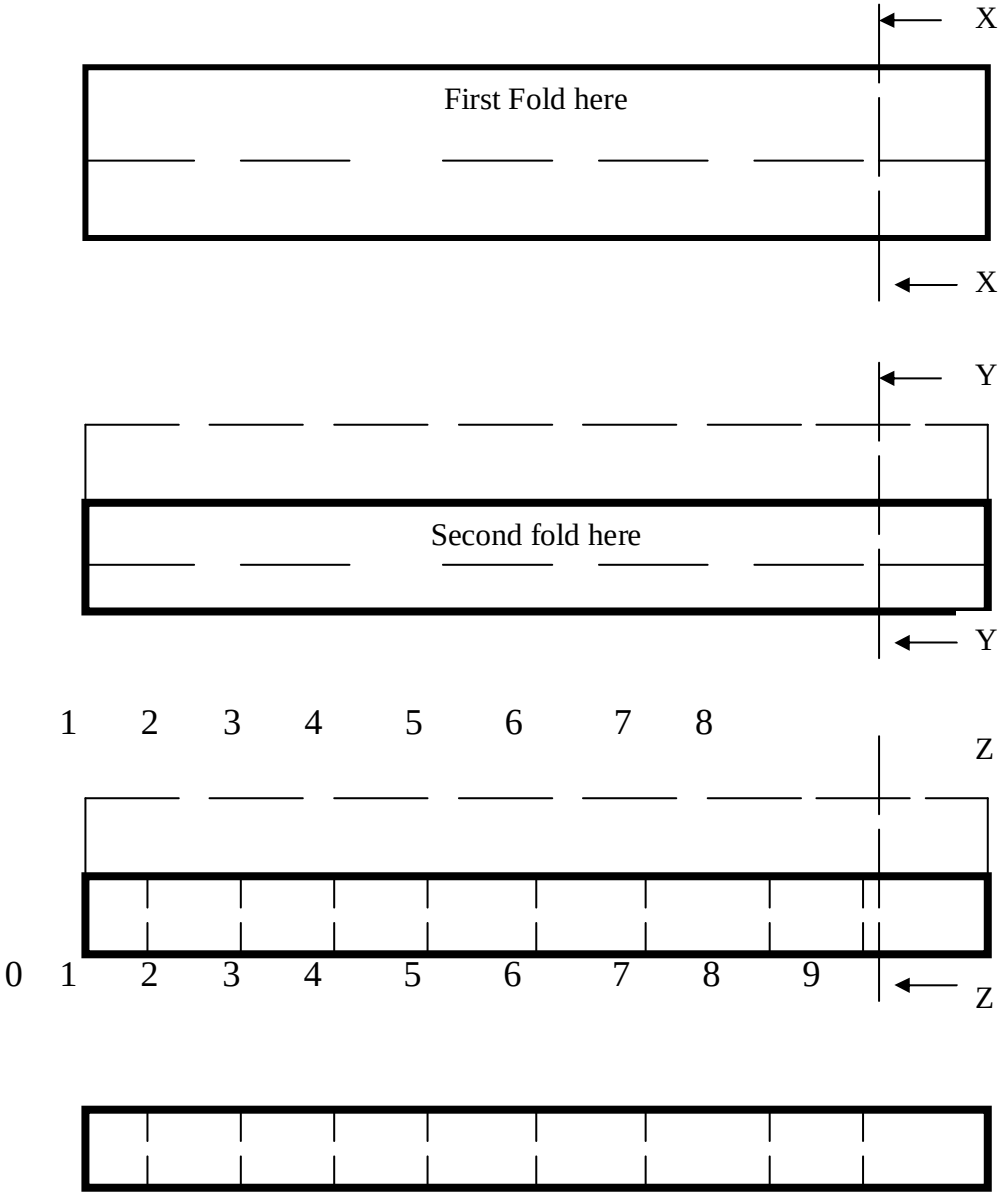
Requirements of Handloom cotton gauze, absorbent, non-sterilized

S. No.	Characteristic	Requirement
1	Count of yarn (for guidance only) a) Warp b) Weft	17 to 25 tex (24s to 34s) (17 to 25 tex) 24s to 34s)
2	Threads / dm a) Ends, Min b) Picks, Min	75
3	Mass, g/m^2	55
4	Length, m Tolerance	30 $\pm$ 5
5	Width, cm Tolerance	As agreed - 2 percent
6	Absorbency	10 seconds, Max
7	PH value of aqueous extract	6.5 to 8.5
8	Scouring loss	1 Precent, Max
9	Freedom from optical whitender	Non fluorescence

Packing: Gauze cloth shall be folded and packed with such materials and in a manner so as to protect its absorbency and allow normal handling and transport without teasing and exposing the content. A suitable packing procedure is as given below:

The gauze is folded widthwise to reduce the width of cloth to ¼ as shown in figure. It is further folded lengthwise making 9 layers of cloth or rolled it as shown in figure. In case of gauze having length of 3 meter or more, the same may be rolled in place of folding. The gauze so folded or rolled shall be covered completely in blue or brown paper wrapping and securely glued or gummed. Such individually wrapped dressing in requisite number shall be wrapped in one layer of paper securely glued or gummed to form a packet. In case of cotton gauze of 15 m or above, the pieces may be individually wrapped or rolled in a single layer of Kraft paper and securely sealed at both ends with gum tape to form a packet.

Method of folding cotton gauze in layers



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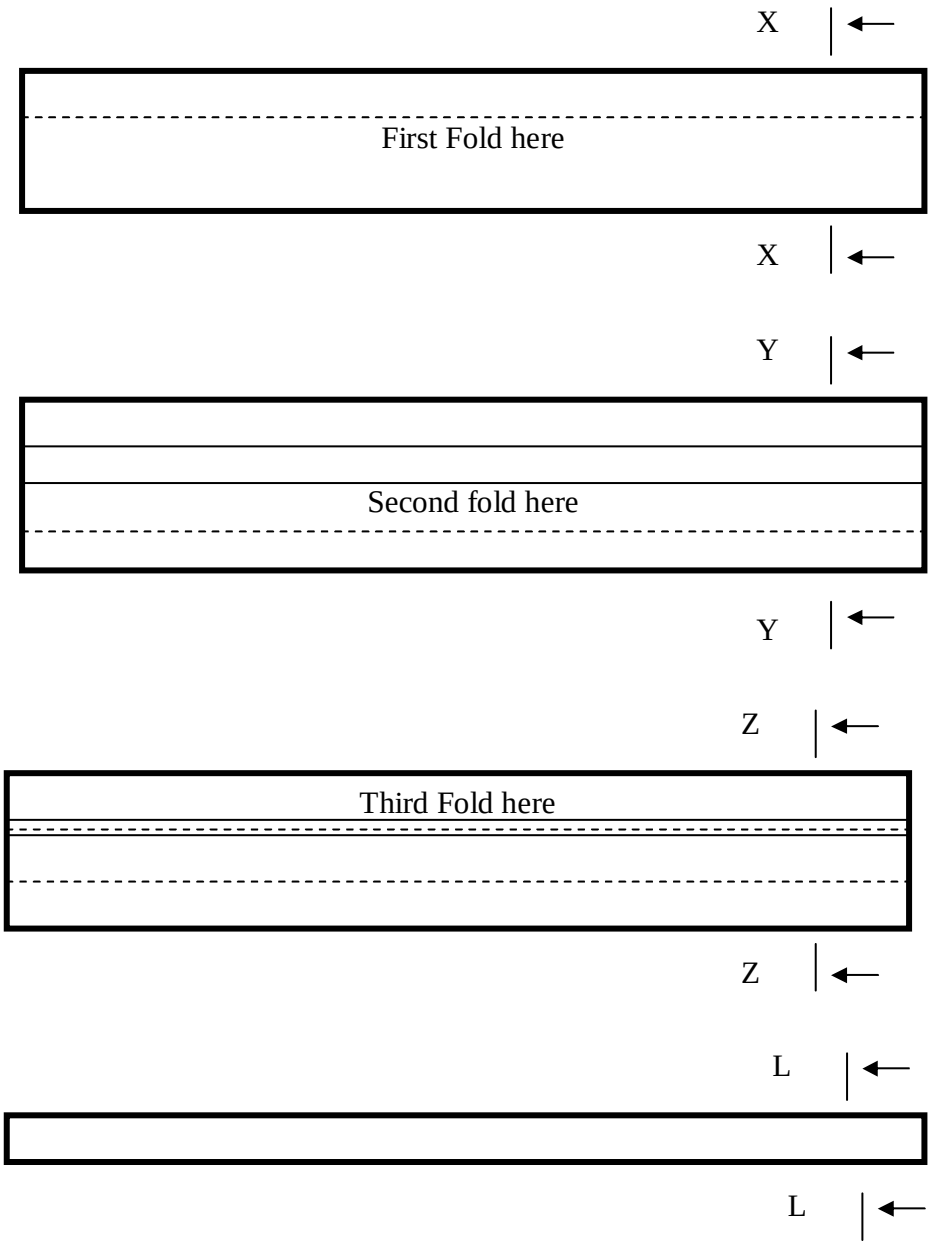
Method of folding cotton gaze into rolls



Marking: Each pack shall have a label marked with following information:

- Name of material
- Manufacturers name or trade mark
- Month & year of manufacture
- Width in centi meter and length in meters
- The word non-sterilized or sterilized.

3.2 Cotton Bandage

BIS has prescribed the constructional particulars and other requirements for cotton bandages cloth, bleached and non sterilized as follows:

Cloth- The bandage cloth shall be woven in plain weave with well formed selvedge and free form weaving defects. It shall also be free form filling, wising or dressing materials. The cloth shall also be bleached. The bandage cloth shall conform to the requirements given in table below:

Requirements for Handloom Cotton Bandage Cloth and Cut bandages:

S. No.	Characteristic	Requirement
1	Count of yarn (for guidance only) a) Warp b) Weft	 20 to 25 tex (24s to 30s) 25 to 30 tex(20^s to 24^s)
2	Threads/ dm, Min a) Ends b) Picks	 150 85
3	Mass, g/m^2	57 $\pm$ 5
4	Length, in tolerance	As agreed or declared - 1 percent
5	Width, on, tolerance	As agreed or declared - 1 percent
6	pH value of acqueous extract	6.5 to 8.5
7	Scouring loss, Max	2.0 percent
8	Freedom from optical whitener	Absence of fluorescence

Packing:

Bandage cloth shall be packed securely so as to allow normal handling and transport without tearing and exposing the contents. Bandage cloth suitably folded one layer over the other shall be wrapped with two layers of craft paper. Cut bandages shall be made in to rolls in the form of dressing of specified width and length. Each dressing shall be neatly and securely wrapped with blue or brown paper wrapping around its circumference only leaving the cut ends uncovered. Five, ten or twenty such dressings shall then be wrapped to from a packed. The packet shall be gummed or glued at each end. These packets then shall be packed in a waterproof bulk pack marking.

Each packet shall have a label marked with the following information:

- Name of material
- Manufacturers name or trade mark
- Month & year of manufacture
- Width in centi meter and length in meters
- The world not sterilized.

3.3 Surgical Cotton

Surgical cotton sterilized is covered under pharmacopoeia and the requisite specifications need to be adhered.

CHAPTER 4 - RESOURCES

4.1 Main Resources

The main resources for the production of gauze, bandages and absorbent cotton include the following:

- Land and building
- Plant and machinery
- Gauze bandage cloth, raw ginned cotton, chemicals and consumables
- Power
- Water
- Skilled and non-skilled workers

It has been envisaged in the project the land for the project would be available on lease basis from Government of Bhutan and the building as per standard requirements has to be constructed for the formulation unit. There would be two production sections of the unit viz gauze and bandage section and absorbent cotton section. Specially for surgical cotton, persons having sufficient experience in the production of surgical cotton need to be employed by the unit. Similarly, in case of gauze and bandage, the experienced staff need to be employed since in both these cases, not much assistance is available for machinery manufacturers in the setting up of the production process.

4.2 Raw materials and consumables

Bandage and gauzes: the main raw materials for the manufacture of gauze and bandages would be as under:

- Gray gauze / bandage cloth
- Bleaching agent and washing chemicals
- Packing materials
- Glue, adhesives and gummed label.

Absorbent cotton: the manufacturing unit for absorbent cotton shall require the following raw materials:

- Raw Ginned Cotton
- Chemicals viz. bleaching agent, soda ash, caustic soda and other chemicals.
- Packing paper & other packing materials like gunny bags.
- Glue, gummed labels and adhesives.

4.4 Comparative analysis of sources and prices of critical inputs & consumables

As mentioned earlier, various raw materials required for manufacture of absorbent cotton and gauze & bandages include the following: -

A). Absorbent cotton

- Raw Ginned Cotton
- Chemicals viz. bleaching agent, soda ash, caustic soda and other chemicals.
- Packing paper & other packing materials like gunny bags.
- Glue, gummed labels and adhesives.

B). Gauze and bandages

- Gray gauze / bandage cloth
- Bleaching agent and washing chemicals
- Packing materials
- Glue, adhesives and gummed label.

The major raw material for absorbent cotton is raw ginned cotton while for gauze and bandage, grey fabric is the main raw material. Raw ginned cotton need to be imported from cotton dealers of India or from other neighboring countries. Kanth / Muradabad in U.P. (India) happen to be the main centre for grey fabric for gauze and bandages and this may be procured from Kanth. The bleaching and washing chemicals and packaging material need to be procured from wholesale dealers in these items.

4.5 Recommended sources

A list of raw material supplier has been given in the Annexure II. As mentioned above, it would be more economical to purchase the paper directly from paper mills.

4.6 Annual requirement of raw materials

The annual requirement of various raw materials along with their prices have been given in the chapter 9 relating to cost presentation.

CHAPTER 5 – THE PLANT

5.1 Selection of technology

The technologies for the production of gauzes, bandages and absorbent cotton are relatively simple technologies. In case of gauze and bandages there are two stages of production, the first being weaving of the fabric and the second being washing bleaching of the fabric, cutting the gauze and bandages, sterilization and packaging. In this context it is proposed that the unit in Bhutan may implement the project in two phases. In the first phase the unit may start with the grey fabric as the basic raw material and carry out bleaching, washing, cutting and packaging and sterilization operation. In the latter phase, the unit may install the fabric weaving looms and start with the cotton yarn as their raw material.

It is pertinent here to mention that as a commercial practice in India also these stages of operations are carried out in different units and even at different locations. Places like Kanth – Muradabad in Uttar Pradesh have a large concentration of looms for weaving the gauze and bandage fabric. The grey fabric from such weaving clusters is taken to gauze and bandage manufacturing units in different parts of the country where it is bleached, washed, cut in to desired size and packed. However on environmental considerations to begin with operations could be started with bleached and washed fabric also which would require only cutting sterilization and packaging. Alternatively bleaching and washing of fabric could be carried out at separate location where safe disposed of liquid effluents would be possible.

In case of surgical cotton however all operations need to be carried out in the proposed unit. The project envisages the production of gauze and bandages with grey fabric as the starting raw materials.

5.1.1 Process Technologies used

As mentioned above, for the production of gauze, bandages and surgical cotton normally following type of process technology are used

- Handloom weaving of grey fabric, manual / semi-automatic bleaching and washing of grey fabric, cutting and packaging of bandages.
- Processing of raw ginned cotton to absorbent cotton, drying and packaging.

5.1.2 Factors influencing the choice of technology

A number of factors need to be taken into considerations while deciding the choice in favour of a process technology. These factors mainly include

- Factor inputs.
- Market findings viz size of market and recurrence of repeat demand.
- Purchasing power of consumers and prevailing price spectrum.
- Future projections of market demand.
- Availability of skilled manpower and support facilities.

- ❖ Availability of infrastructure and transport facilities.
- ❖ Environmental considerations.

5.1.3 Technology recommended

In case of gauze and bandage, it has been recommended that the manufacturing process may be started from grey cloth and the manufacturing operation would include bleaching and washing of the fabric followed by cutting and packaging. In case of absorbent cotton, all operations need to be carried out starting from raw ginned cotton.

5.2 Production capacity

The production capacity of the unit has been calculated on the basis of 80% utilization of the installed capacity of the machines in absorbent cotton section and bandage and gauze section. The production capacity per annum of the unit, on single shift operation and 300 working days basis would be as under: -

Absorbent cotton	– 300 MT tonnes
Bandages of assorted sizes	– 13.5 lacs dozen
Gauze Rolls	– 1,20,000 rolls

5.3 Details and specifications of machinery and specifications:

A). Absorbent cotton manufacturing section – The details and specification of the machines and equipment required for the manufacture of absorbent cotton are as under.

1) **High pressure Kier** (MS) with inside coated with acid resistant epoxy coating fitted with pump for circulation of reagents steam pipe for heating, capacity 2000 kgs. Charges of cotton fitted with all accessories.
2) **MMC Revolving flat high production carding machine** 1016 mm width with dust extractor, electronic stop motion, brush rolls stripping brush rolls, filet grinder and other accessories.
3) **Two compartment continuous cotton dryer** with steam heating arrangements, at 100 psi capacity 100 kg chamber of drying loose open cotton per hour provided with trolley electrical heaters and electric control panel.
4) **Porcupine cleaner** 1200 mm working width 406 mm diporcupine type cylinder with strikers, each striker having two striking edges, centrally adjustable grid bars and reduction gear, electric motor (5 HP) for materials transport with accessories.
5) **Centrifugal hydro extractor** with S.S. basket dia 1000 mm fitted with Motor and other accessories.
6) **Wet Cotton opener** working width 1000 mm fitted with motor and all necessary accessories.
7) **Vertical opener** with 7 steel discs and three separate centrally adjustable settings for beater and grid bars fitted with motor 5 HP complete with all accessories.

8) **Single soutcher and lap machine** 1065 mm working width with kirschener beater, centrally adjustable grid bars, High pressure device for loading calendar rollers and lap racks etc., for making lap doffing arrangement with extended lap holder for continuous operation with 10 HP motor starter etc.
9) **Rolling and winding machine** 1320 mm on face complete with motor starter and other accessories.
10) **Small band saw type machine** with motor for roll cutting machine.
11) **Air compressor** for lapping machine.
12) **Thermo-pack boiler** 1000 kg/hrs evaporation capacity, 50 psi complete with feed pump and accessories.
13) **Water overhead tank** of 10000 liters capacity and tube well fitted with accessories.
14) **Effluent Treatment Plant** for treating the process effluents.

B). Gauze and bandage manufacturing section

1) **MS Kier** wall thickness 1/4" bottom 8 feet
2) **SS Winch machine** 6-4' X 6X6 size 150 kg
3) **Hydro extractor** 40-45 kg capacity
4) **Steam calendaring machine** roller size 51/20
5) **Cylinder drier** with motor and gearbox
6) **Baby boiler**
7) **Roll Winding machine** for making large rolls of fabric with aluminium square rolls
8) **Winding machine** for conversion of large rolls to small rolls with paper coverings
9) **Roll cutting machine**
10) **Stamping / printing machine**

5.4 Process of manufacture

The manufacturing unit shall have two main production departments, the first for the production of gauze and bandages and the second for the production of absorbent cotton.

5.4.1 Gauze and Bandages

The manufacturing process for gauze and bandages involves the following stages of production.

Weaving of cloth- Cotton yarn confirming to requisite specification available from spinning mills is woven in the form of open mesh fabric of desired warp and weft count with the help of handloom or powerloom. This is called gray fabric and it is non absorbent.

Bleaching & Washing: The grey fabric is bleached in boiling kiers and bleaching tubs wherein it becomes white and absorbent. The bandage cloth is also treated with starch. The bleached white fabric is dried by passing in continuous length through a tentering machine. This machine straightens, stretch and hold the gauze taut as it is dried. The bleached white fabric is in the form of rolls of 18-20 meters or as per requirement and transferred to cutting and folding section.

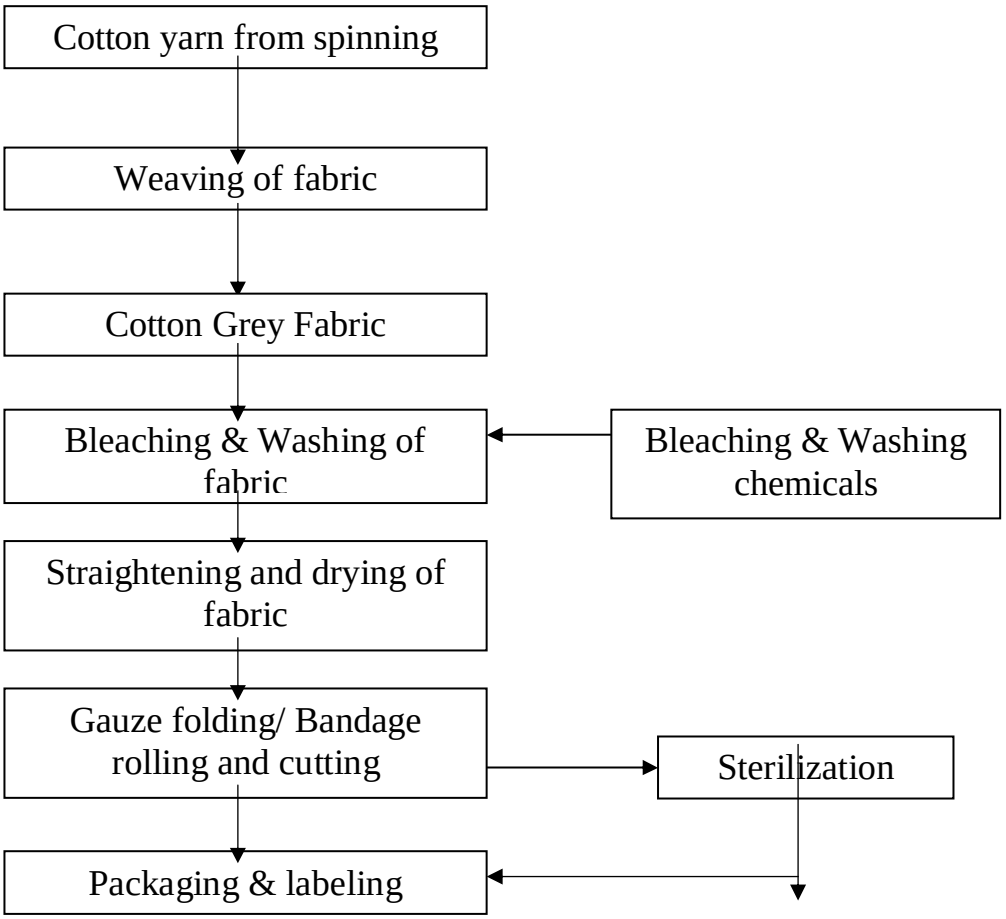
Cutting and packaging: The bandage cloth available is fed into the winding machine for making roll of bandage cloth as the cloth is available in 18 meters length. After sufficient length i.e. about 200 or 300 meters is wound or aluminium square rolls provided for the purpose, this roll will be ready for making small rolls of 3 or 5 meters length or whatever desired length. The bandage roll after winding on the winding machine is put on rolling machine to wind it on stainless steel rod provided under pressure roll to get nicely compressed rolls of different size from 3-4 meter. The paper for covering the roll is passed over the felt roll which rotates by friction of cloth. An adhesive solution is applied at the end of the paper, then the machine again started so that the paper covers entire roll.

The bandage rolls thus prepared can be cut into desired length pieces on the bandage roll cutting machine. Generally the pieces are cut into 3 inch to 6 inch widths. After cutting is over, the cut rolls will drop from the chute fitted on the table. These rolls are charged in autoclave for sterilization for about 5-10 minutes. Thereafter these rolls are collected and packed in dozens or gross for marketing.

A similar process in used for the manufacture of gauze cloth wherein specification of fabric & size of folded gauze is different. The gauze also needs to be sterilized before final packaging.

The process flow chart for the production of gauze and bandages is depicted as under:

Process flow chart for the production of bandages & gauzes



5.4.2 Surgical Cotton:

The manufacturing process for the surgical cotton involves the following stages of production:

Opening and clearing: Raw cotton in bale form or otherwise is opened in crighton opener where it is loosened and dust and other particles are removed. The cotton is then sent to a kier where it is steam, boiled for about 3-4 hours after adding chemicals such as caustic soda, soda ash, detergent etc. This treatment removes much of the natural waxes and oils and softens and disintegrates any foreign matter that may remain after cleaning operation.

Washing:- After the cotton is boiled it is removed from the kier and taken to the tanks for washing.

Bleaching; The washed cotton though absorbent is not of good colour. It is therefore bleached with chemicals such as hydrogen peroxide or sodium hypochlorite. The bleaching not only

whitens the cotton but also improves its wetting properties and assists in disintegration of any remaining foreign materials.

Alkali Removing:- The bleached cotton is thoroughly washed again to remove the chemicals. A small amount of diluted sulphuric acid is also added to neutralize alkali excess. The cotton then is passed through hydroextractor to remove water. It is then sent to a wet cotton opening machine.

Drying;- the cotton so opened is then passed through dryer. Where drying machine is not there the cotton is subjected to sun drying. This method, however, restricts the capacity of the unit besides the cotton getting mixed up with dust.

Lapping:- After the cotton is dried it is again sent to the blow room where it is thoroughly opened and made into laps.

Carding; The laps are then fed into the carding machine where cotton comes into thin layers.

Rolling:- Paper is inserted under the laps and the cotton is rolled and simultaneously compressed.

Weighing and cutting: The rolls are then weighed and cut according to the required size. The cut rolls are then further packed in a polythene roll after labeling and putting the weight mark and then sent for final packing. The process flow chart for the production of surgical cotton is as given below;

5.5 Technical know-how

The production of gauze and bandages in the proposed unit has been envisaged from gray fabric as the starting raw material and the unit has to carry out the bleaching, washing, cutting of the fabric and packaging operations. These operations are relatively simple and could be easily adapted by the local workers with some initial training at similar units in India specially those supplying gray fabrics. To begin with the services of experience persons in this line of production need to be availed by the unit. In case of surgical unit, the persons having sufficient on the floor experience in a similar production unit need to be employed, so as to produce the quality products meeting the requirement of standards. It is relevant to mention here that in both these cases, not much technological assistance is available from the machine manufacturers for the production of surgical cotton or bandages.

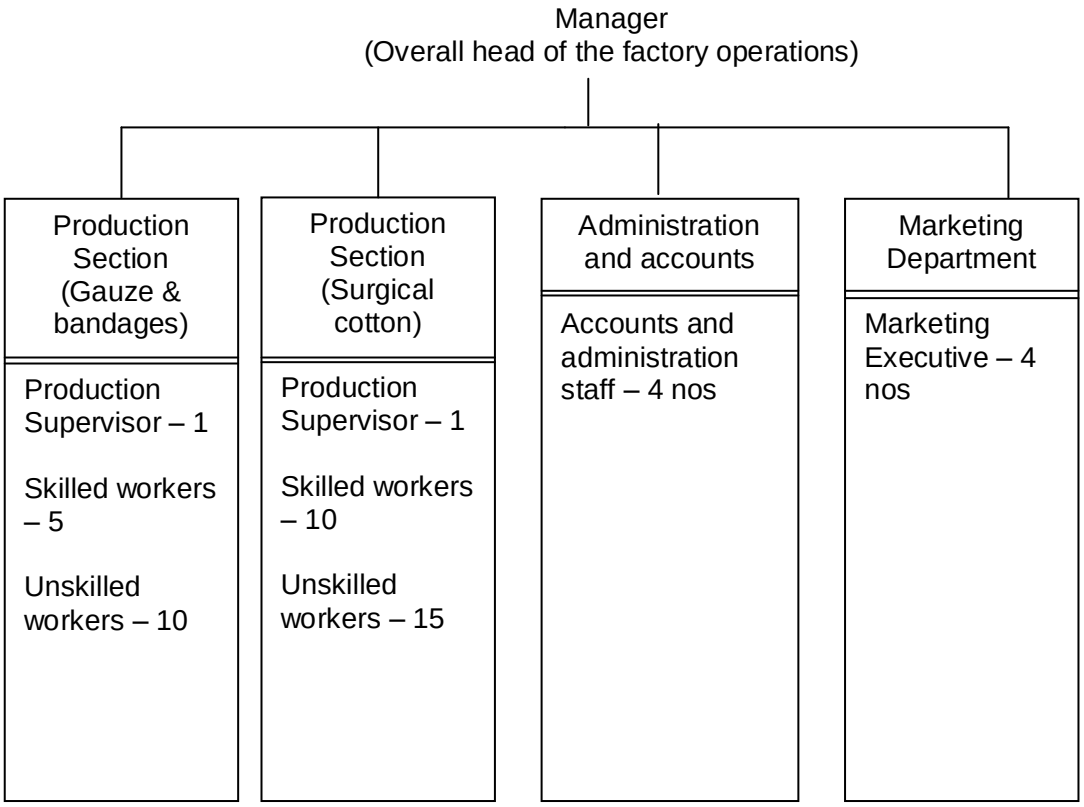
5.6 Requirement of Power, Fuel and utility

The requirement of power for both the production section and general lighting purpose would be 91 KWH. Beside, there is a consumption of fuel worth Rs. 40,000/- per month, both in the production of surgical cotton and bandages. The fuel consumption is mainly for heating purpose during bleaching and washing of cotton and fabric. There is a requirement of water in the process of manufacture for washing of cotton and fabric.

5.7 Requirement of manpower

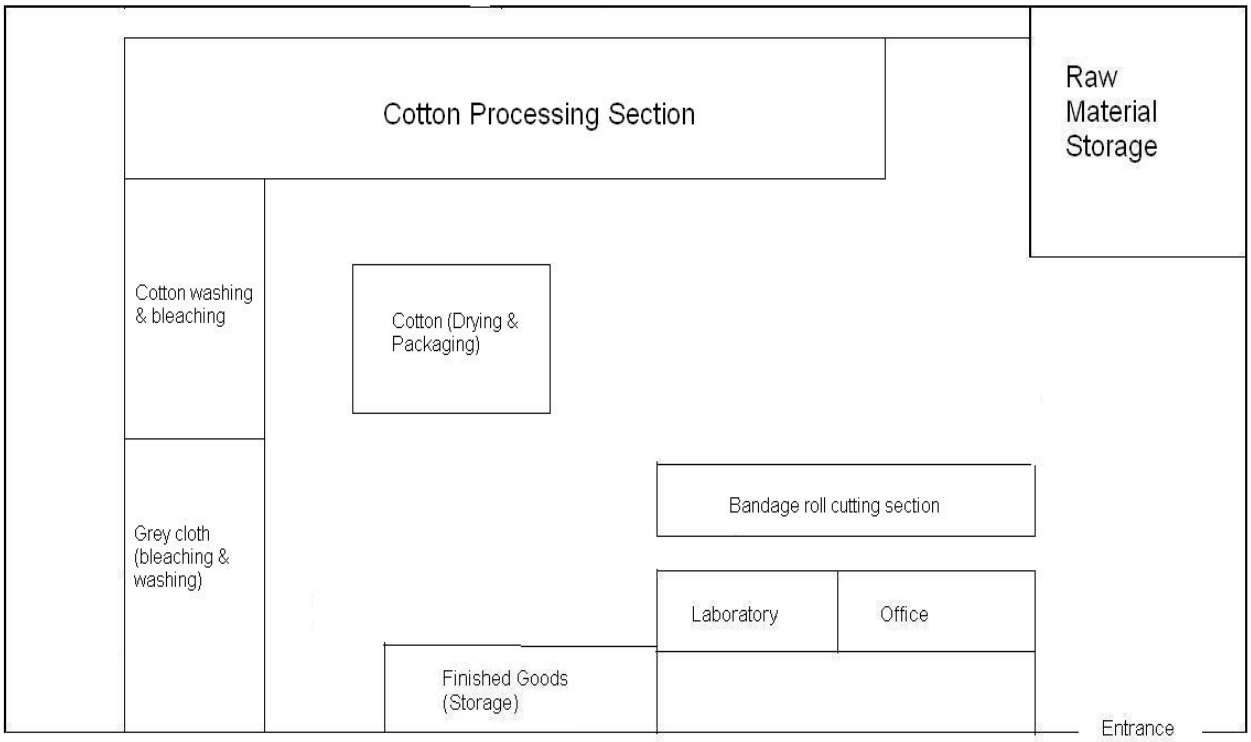
The annual production turnover and the financial projections are based on single shift operation of machines. For operation of the unit, 5 managerial and office staff, 4 marketing executives, 15 skilled workers and 25 unskilled workers would be required. In case the unit is required to be operated in more than one shift, additional staff would be required. In addition to this, there would be a requirement of contract workers during the construction phase of the factory and installation of machinery and equipment. The organization chart for single shift operation would be as under:

5.8 Organization Chart



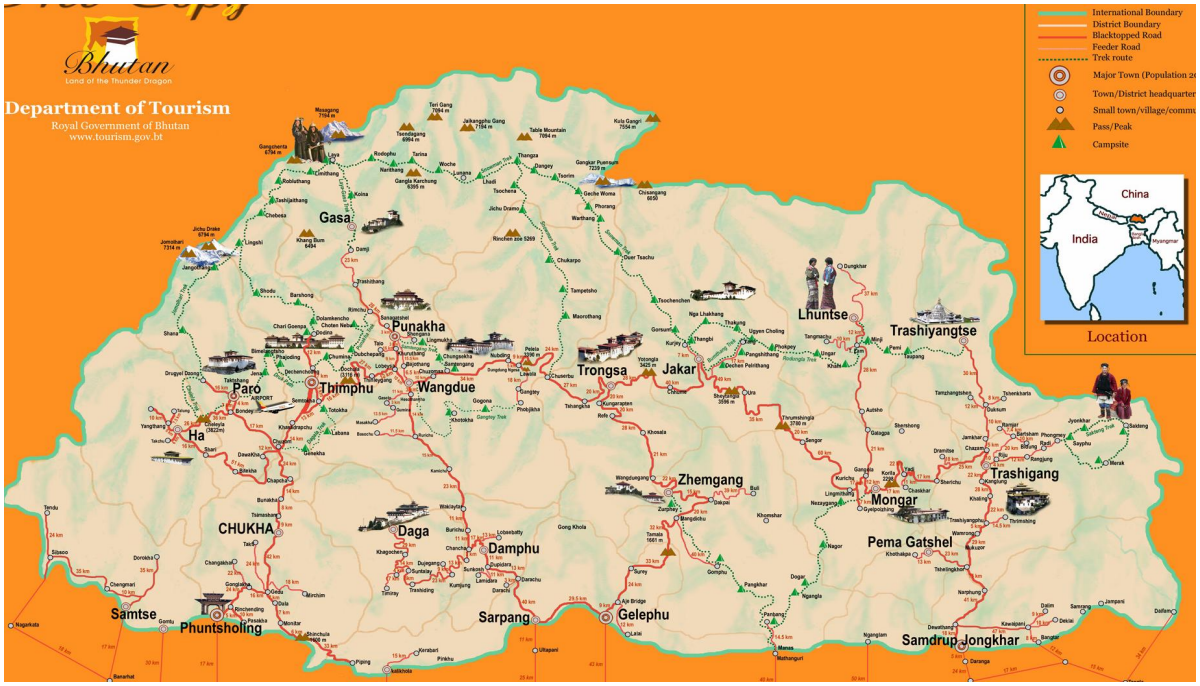
The project has a good employment potential for skilled and unskilled workers which would be employed in the production unit. Beside the project would generate employment potential in marketing & sales of its produce, transport of raw materials and finished products. The project would thus create opportunity both for direct & indirect employment.

5.9 Plant Layout



CHAPTER 6 – PLANT LOCATION AND INFRASTRUCTURE

Thimphu, Phuentsholing, Punakha, Gelephu, Samdrup and Paro being the major towns constitute the main markets for gauze, bandage and absorbent cotton have potential for setting up such a unit. However, keeping in view that all the raw materials viz gauze, bandage cloth and raw ginned cotton, etc which have high weight to volume ratio are required to be imported from India, the location of the unit near to Indian border would be quite logical with a view to reduce the cost of transport of raw materials. Further, a central location vis a vis major towns could be advantageous. It is further relevant to mention that at present, majority of the supplies of surgical cotton, gauze and bandage in Bhutan are procured by the government and this important aspect has to be kept in view while selecting the location of the unit.



In order to select the suitable location for the manufacturing plant, various parameters viz availability of land, environmental conditions, investments considerations, operational logistics, future development possibilities, socio-economic factors including services like transport facilities etc. have been taken into consideration for ranking the locations. The table below shows the ranking of locations:

Ranking of possible locations based on various parameters

		Weightage of location related parameters						
S. No.	Locations	Land access conditions	Environmental Conditions	Investment Consideration	Socio economic factors	Operational Logistics	Future development possibilities	Overall Rating
1	Phuentsholing	7	9	9	8	9	7	**49**
2	Thimphu	7	7	7	7	5	7	**40**
3	Paro	7	7	5	6	7	5	37
4	Gelephu	7	7	7	5	5	5	36
5	Punakha	7	7	5	6	5	5	35
6	Samdrup	7	7	5	4	7	5	35

It is therefore proposed that the unit be located in the Industrial Estate at Phuentsholing or Pasakha. The requisite infrastructure viz land, power, road transport and communication facilities required for the proposed unit are available both in Phuentsholing and Pasakha. The project has been conceptualized in totality and all the manufacturing operations are proposed to be carried out in the unit itself. The project has an inbuilt provision for spare parts, components and tools and the cost for the same has been incorporated. There may be some requirement of minor mechanical or electric repairs which could be taken care of by the skilled workers of the unit. Alternatively, the services of the existing mechanical and electrical repair workshops in Phuentsholing could be availed. As mentioned earlier, the grey cloth has been taken as starting raw material for production of gauze and bandages which requires to be procured from outside viz India. At a later stage, the production facilities for weaving the grey cloth could be promoted in Bhutan and these units could serve as supporting ancillaries units to the proposed project.

Government of Bhutan happens to be the major buyer for gauze, bandages and surgical cotton. Therefore, it would advisable if the unit is setup near to the capital city. Further, a large quantity of grey fabric and raw ginned cotton having large volume to weight ratio are required to be transported to the manufacturing site as raw materials. The transport cost of raw materials needs to be kept at lowest possible level. As most of the materials are likely to be procured from India, Phuentsholling could be the preferred location for the proposed gauze, bandages and surgical cotton manufacturing unit.

CHAPTER 7 – ENVIRONMENTAL IMPACT

7.1 Environmental aspect of manufacturing process

As stated earlier, the starting raw material for the production of gauze and bandages would be grey fabric and raw ginned cotton for the production of absorbent cotton. A process operation of washing, bleaching with use of chemicals is involved both in the production of gauze, bandages and absorbent cotton. A provision of steam boiler also has been made in the list of machines. Consequently, there will be some liquid effluents from both the manufacturing department engaged in the production of gauze, bandages and absorbent cotton. These liquid effluents having alkali, acidic and some chemical impurities need to be treated prior to discharge in the drain. A provision of water treatment plant has been made in the list of machines, so that no pollutants enter to the water stream. There is a provision for installation of a boiler also in the unit and this would be electrically heated, thermo-pack type boiler and there would be no pollution angle. As such, adequate provisions have been made in the project to minimize the adverse impact on environment.

7.2 Waste generated and mitigation measures

As mentioned above, there would be some liquid effluents during the manufacture of absorbent cotton, gauze and bandages as the process involves washing and bleaching operations of raw ginned cotton and grey cloth. A provision of water treatment plant has been given in the project. Besides, there would be some waste of metal scrap, wooden scrap, broken bricks, stone aggregates, etc during construction phase of the project. The waste generated during construction phase is mainly used for earth filling & flooring. The details of the waste generated during construction phase and project operation phase along with mitigation measures are given below in subsequent paras.

7.2.1 Waste generated during construction phase

The details of the waste generated during construction phase and the mitigation measures are as under: -

S. No.	Type of waste / scrap	Quantity	Mitigation measures	Impact on Environment
1.	Metal scrap	Around 2-3 % of the steel used in construction	Sold to trade channels for reprocessing.	No adverse impact
2.	Wooden scrap	Around 5-7% of the wood used in construction.	Used as fuel.	No adverse impact
3.	Clay stones, mounds	Depending upon on the	Used for earth filling.	No adverse impact.

		topography of the construction site.		
4.	Brick stone cement aggregate	5% of the quantity used	Used for flooring and earth filling.	No adverse impact

7.2 Waste generated during project operation phase

The details of the waste generated and the mitigation measures are as under:

S. No.	Type of waste	Quantity	Mitigation measures	Impact on environment
1.	Liquid effluents	5-7 kilolitres of liquid effluents with alkaline impurities	Provision of water treatment plant has been made in the project.	No adverse impact
2.	Gaseous effluents	Nil	Not applicable	No adverse impact
3.	Solid effluents or waste	Nil	Not applicable	No adverse impact

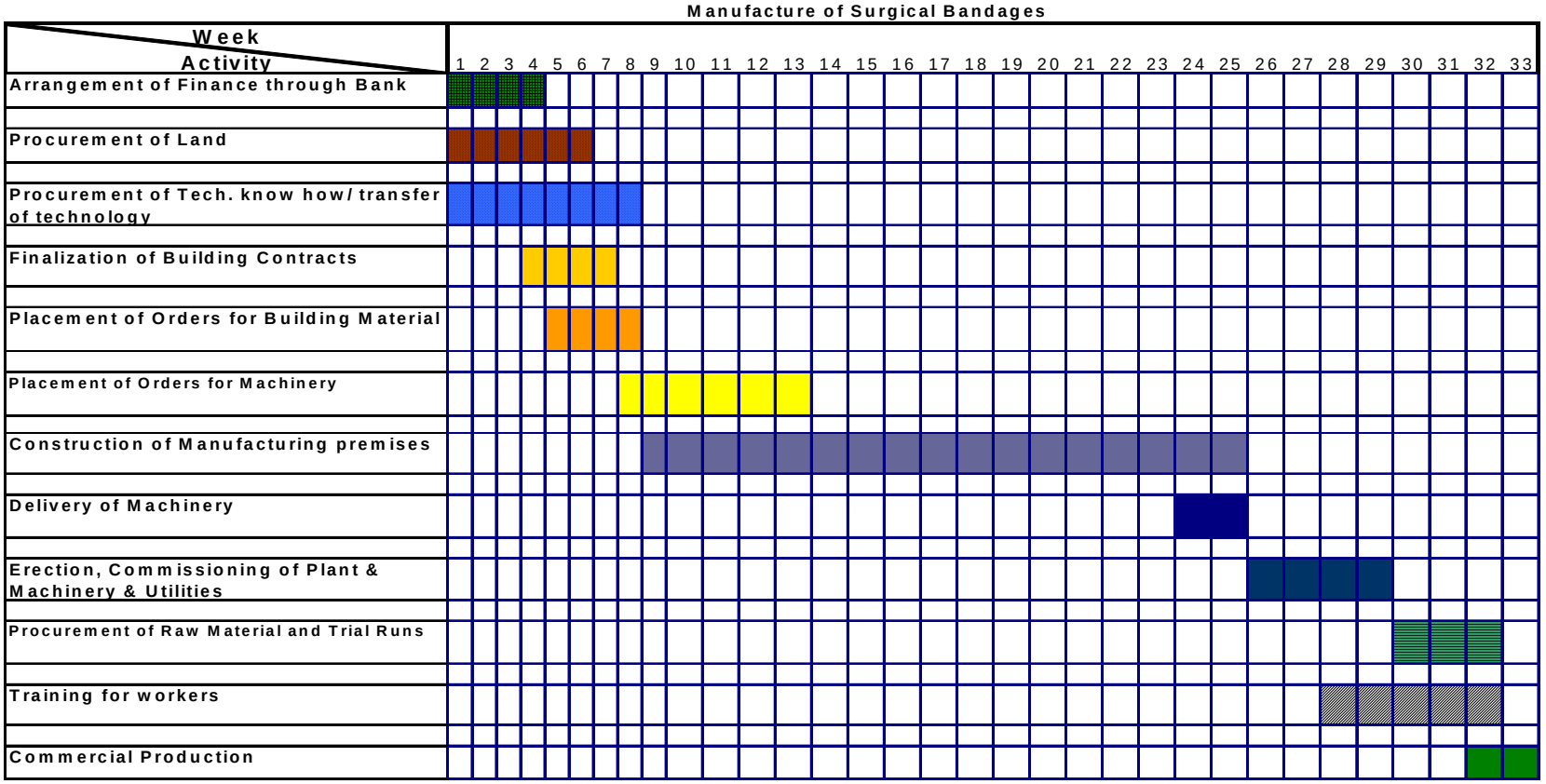
CHAPTER 8 – IMPLEMENTATION SCHEDULE

8.1 Implementation Schedule – Table

Implementation Schedule for manufacture of Surgical Bandage

Particular	From	To	Total Weeks
Arrangement of Funds through Bank/ Own	1	4	4
Procurement of Land	1	6	6
Procurement of Tech. know how/ transfer of technology	1	8	8
Finalization of Building Contracts	4	7	3
Placement of Orders for Building Material	5	8	3
Placement of Orders for Machinery	8	13	5
Construction of Manufacturing premises	9	25	16
Delivery of Machinery	24	25	1
Erection, Commissioning of Plant & Machinery & Utilities	26	29	3
Procurement of Raw Material and Trial Runs	30	32	2
Training for workers	28	32	4
Commercial Production	32	33	1

8.2 Implementation Schedule – Graphic view



CHAPTER 9 – COST PRESENTATION

9.1 Capital Costs

9.1.1 Cost of land and building

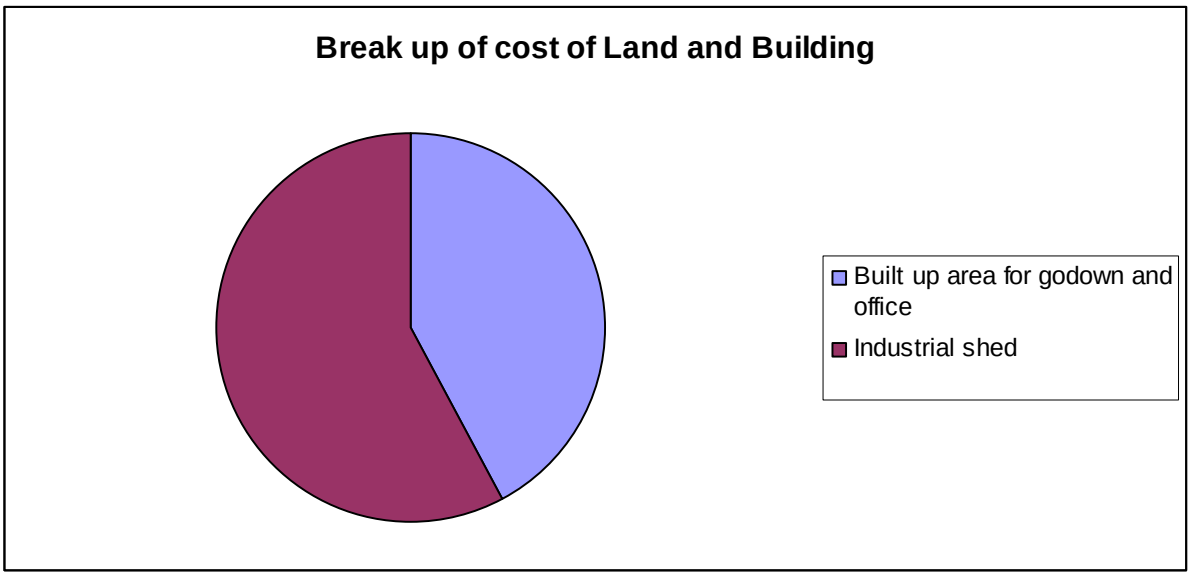
A). Plot and built up area

- Total land requirement	-	1500 sq. mt.
- Constructed area for godowns and offices	-	300 sq. mt.
- Industrial shed for installations of machines:		
- For absorbent cotton department	-	400 sq. mt.
- For gauze & bandages department	-	300 sq. mt.

B). Construction cost

- Built up area for godown and office (300 X 6000)	-	Rs. 18,00,000/-
- Industrial shed for installation of machines (700 X 3500)	-	Rs. 24,50,000/-
Total	**-**	**Rs. 32,50,000/-**

C). Land on lease @ Rs. 10/- per sq. mt / annum



9.1.2 Cost of Machinery and Equipment

A). **Absorbent Cotton Section**

1.	High pressure Kier	1 No.	Rs. 1,75,000/-
2.	MMC Revolving flat high production carding machine	2 Nos.	Rs. 7,50,000/-
3.	Two compartment continuous cotton dryer	2 Nos.	Rs. 6,50,000/-
4.	Porcupine cleaner	2 Nos.	Rs. 2,80,000/-
5.	Centrifugal hydro extractor	1 No.	Rs. 1,00,000/-
6.	Wet Cotton opener	1 No.	Rs. 60,000/-
7.	Vertical opener	1 No.	Rs. 1,10,000/-
8.	Single soutcher and lap machine	2 Nos.	Rs. 6,50,000/-
9.	Rolling and winding machine	2 Nos.	Rs. 65,000/-
10.	Small band saw type machine	2 Nos.	Rs. 20,000/-
11.	Air compressor	1 No.	Rs. 25,000/-
12.	Thermo-pack boiler	1 No.	Rs. 4,50,000/-
13.	Water overhead tank	1 No.	Rs. 75,000/-
14.	Effluent Treatment Plant	1 No.	Rs. 3,00,000/-

B). **Gauze and Bandage Section**

1.	MS Kier	2 Nos.	Rs. 1,50,000/-
2.	SS Winch machine	3 Nos.	Rs. 3,00,000/-
3.	Hydro extractor	2 Nos.	Rs. 1,50,000/-
4.	Steam calendaring machine	1 No.	Rs. 75,000/-
5.	Cylinder drier	1 No.	Rs. 2,50,000/-
6.	Baby boiler	1 No.	Rs. 1,50,000/-
7.	Roll Winding machine	1 No.	Rs. 50,000/-
8.	Winding machine	4 Nos.	Rs. 40,000/-
9.	Roll cutting machine	2 Nos.	Rs. 30,000/-
10.	Stamping / printing machine	2 Nos.	Rs. 20,000/-
	Total		**Rs. 49,25,000/-**

9.1.3 Miscellaneous Fixed Assets - **Rs. 3 lacs**

9.1.4 Pre-operative expenses - **Rs. 5 lacs**

9.2 OPERATING COST

9.2.1 Cost of raw materials

A). For Absorbent cotton section

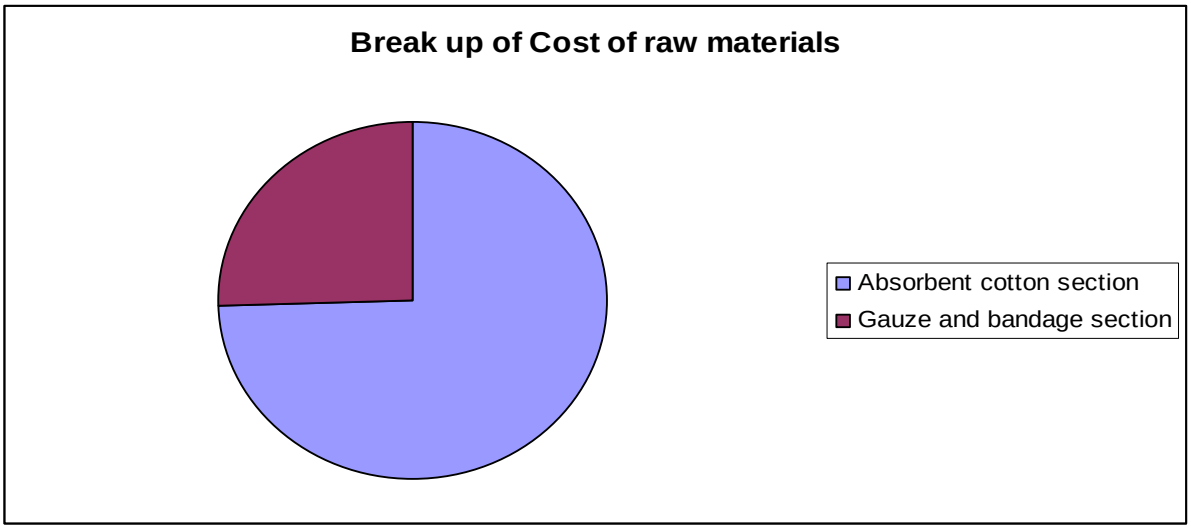
1.	Raw Ginned Cotton (*Rs. 90 per kg)*	-	330 mt. tonnes	-	Rs. 2,97,00,000/-
2.	Caustic Soda Flakes *(Rs. 30/- per kg)*	-	12 mt. tonnes	-	Rs. 3,60,000/-
3.	Soda Ash *Rs. 25/- per kg*	-	6 mt. tonnes	-	Rs. 1,50,000/-
4.	Bleaching Powder	-	6 mt. tonnes	-	Rs. 90,000/-
5.	Misc. Chemicals Packing paper, labels	-	LS	-	Rs. 3,00,000/-
6.	Gum, PE Sheets, sacks, etc.	-	LS	-	Rs. 6,00,000/-
	Sub total			**-**	**Rs. 3,12,00,000/-**

B). For Gauze and Bandage section

1. Rolls of grey cloth in 1 meter width – 1,20,000 rolls – Rs. 96,00,000/-
2. Bleaching & washing chemicals – LS – Rs. 6,00,000/-
3. Packaging box, bags, gum & adhesives – Rs. 5,00,000/-

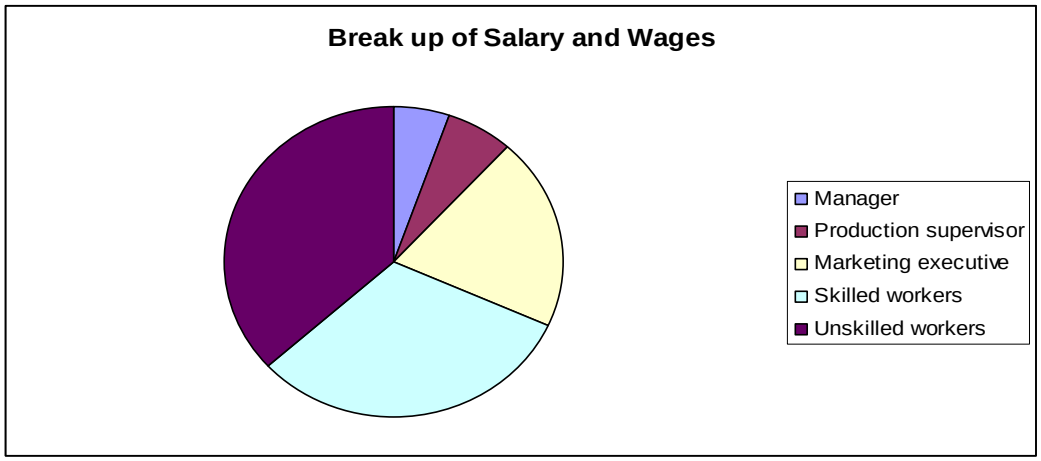
Sub total - Rs. 1,07,00,000/-

Total - Rs. 4,19,00,000/-



9.2.2 Salary and wages

Manager	-	1 no	-	Rs. 25,000/-
Production Supervisor	-	2 nos	-	Rs. 30,000/-
Office staff and Marketing executives	-	8 nos	-	Rs. 96,000/-
Skilled Workers	-	15 nos	-	Rs. 1,50,000/-
Unskilled Workers	-	25 nos	-	Rs. 1,75,000/-
Sub-total			**-**	**Rs. 4,76,000/-**
Total salaries per annum			**-**	**Rs. 57,12,000/-**



9.2.3 Cost of Power and Fuel

Power:

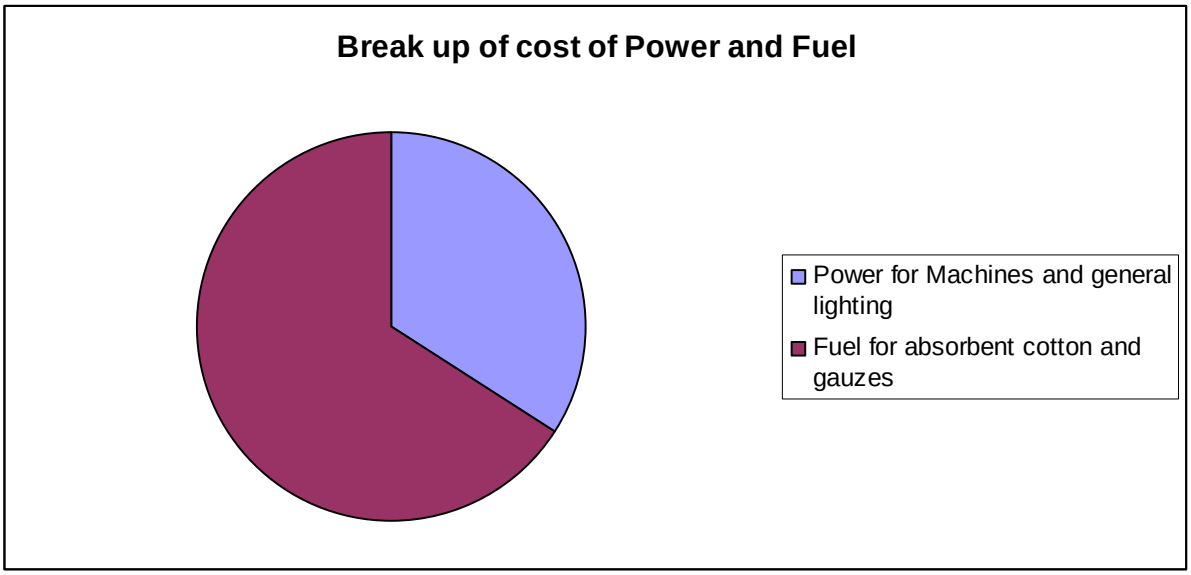
Power requirement for production machines	-	83 KWH
Power requirement for general purpose and lighting Of stores, offices and production unit	-	8 KWH
Total	**-**	**91 KWH**

Annual Cost - Rs. 2,50,560/-

Fuel:
Fuel cost for absorbent cotton and gauze & bandages – Rs. 40,000/- p.m.

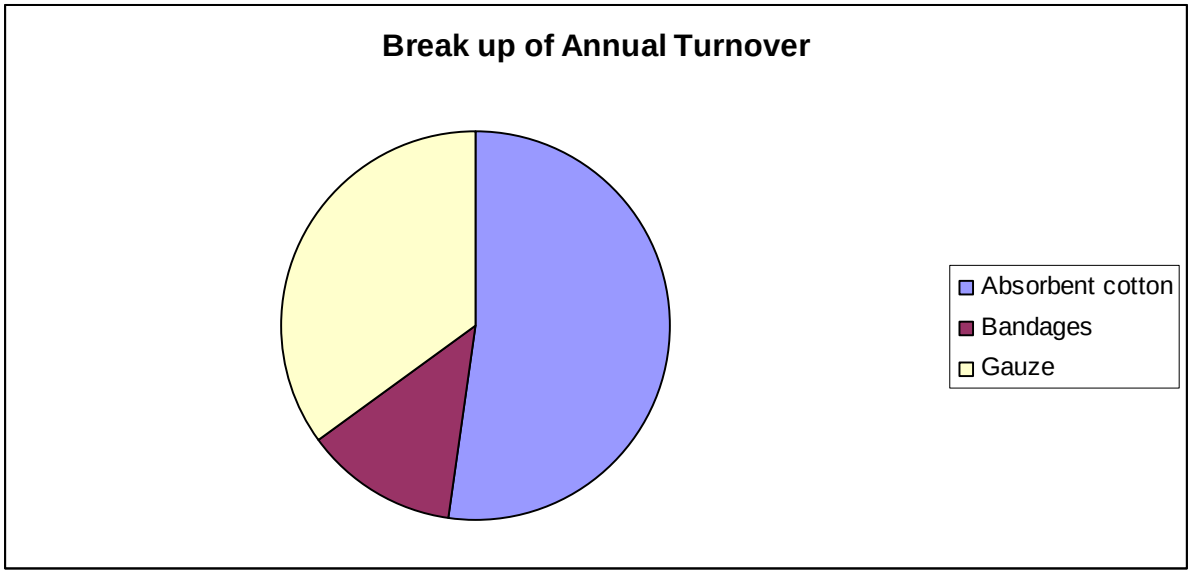
Annual fuel cost – Rs. 4,80,000/-

Total cost of fuel and power – Rs. 7,30,560/-



9.2.4 Annual Turnover

Absorbent cotton In assorted size of rolls packages *@ Rs. 150 per kg*	-	300 mt. tonnes	-	Rs. 4,50,00,000/-
Bandages *13.5 lac dozen of assorted size*	-	13.5 lac dozens	-	Rs. 1,10,00,000/-
Gauze	-	1,20,000 rolls	-	Rs. 30,00,000/-
Total			**-**	**Rs. 5,90,00,000/-**



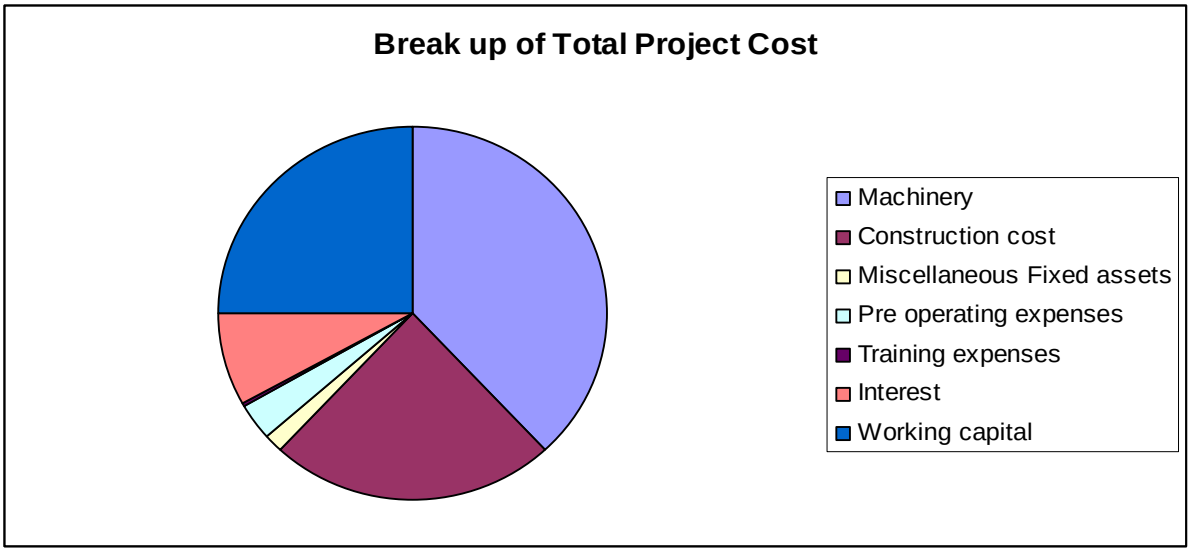
CHAPTER 10 – FINANCIAL ANALYSIS

10.1 Project Assumptions

Assumptions at a Glance		
S. No	**Particulars**	**Rate/Amount**
1	Total Project Cost	176.48
2	Debt	70%
3	Equity	30%
4	Rate of Interest	12%
5	Depreciation (Building)	SLM 10 yrs
6	Depreciation (Machinery)	200%
7	Tax	30%
8	Construction Cost (Building) per sq. m	6000
9	Construction Cost (Shed) per sq. m	3500
10	Repayment period of Debt	8 yrs
11	Moratorium period	1 yr.
12	Installed Capacity (Units in Thousands)	2062.5
13	Capacity Utilization	80%
14	Working Capital Cycle	1 month

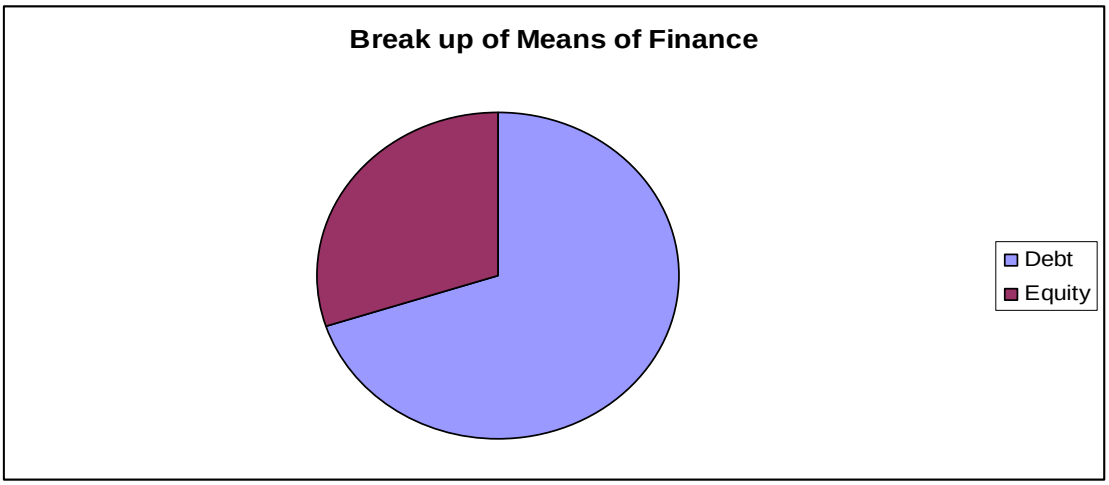
10.2 Total Project Cost

Total Project cost (Rs. in lacs)		
1	Machinery	66.98
2	Construction Cost	42.50
3	Miscellaneous Fixed Assets	3.00
4	Pre operating Expenses	5.00
5	Training Expense	0.67
6	Interest	14.18
7	Working Capital	44.16
	Total	**176.48**



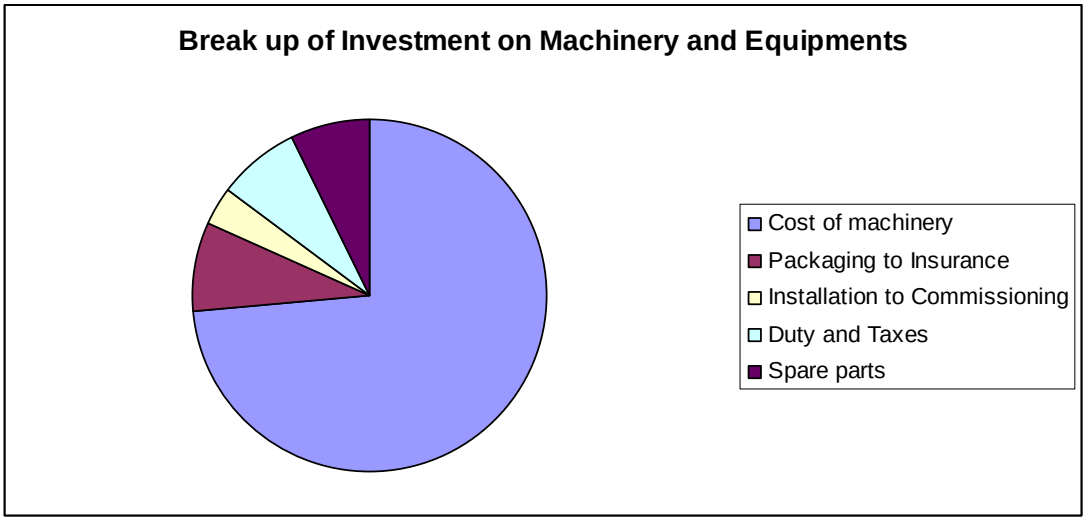
10.3 Means of finance

Means of Finance		
	Rs. in lacs	
Debt	123.54	70%
Equity	52.95	30%
Total	**176.48**	**100%**



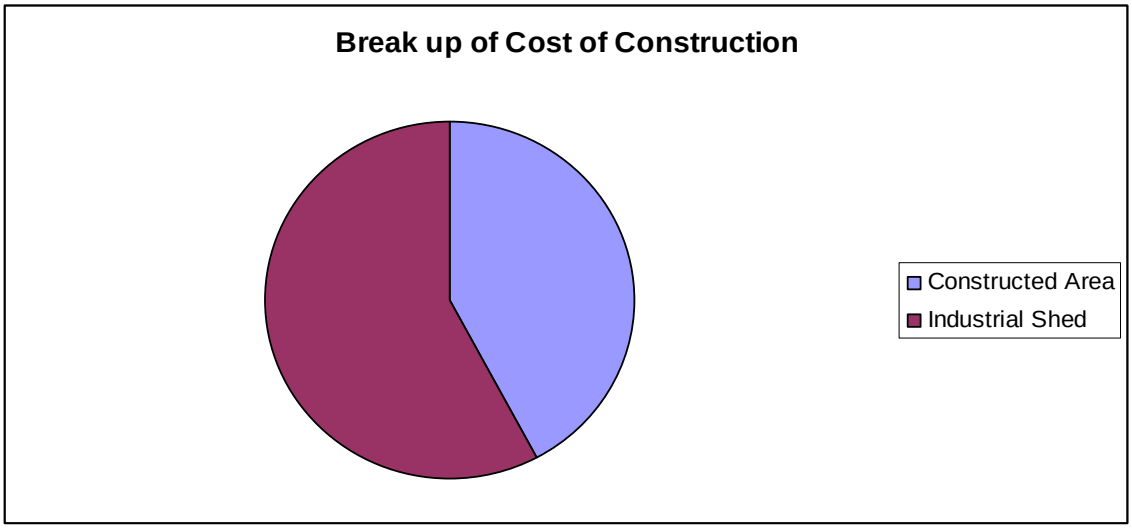
10.4 Investment of machinery and equipments

	MACHINERY	
	A). Absorbent Cotton Section	
	M1	175,000
	M2	750,000
	M3	650,000
	M4	280,000
	M5	100,000
	M6	60,000
	M7	110,000
	M8	650,000
	M9	65,000
	M10	20,000
	M11	25,000
	M12	450,000
	M13	75,000
	M14	300,000
	B). Gauze and Bandages	
	M15	150,000
	M16	300,000
	M17	150,000
	M18	75,000
	M19	250,000
	M20	150,000
	M21	50,000
	M22	40,000
	M23	30,000
	M24	20,000
	Total	**4,925,000**
Add	Packaging, forwarding, transport and insurance @ 11%	541750
Add	Installation, erection and commissioning @ 5%	246250
Add	Duty and taxes @ 10%	492500
Add	Spare parts @ 10%	492500
	Total Cost	**6,698,000**



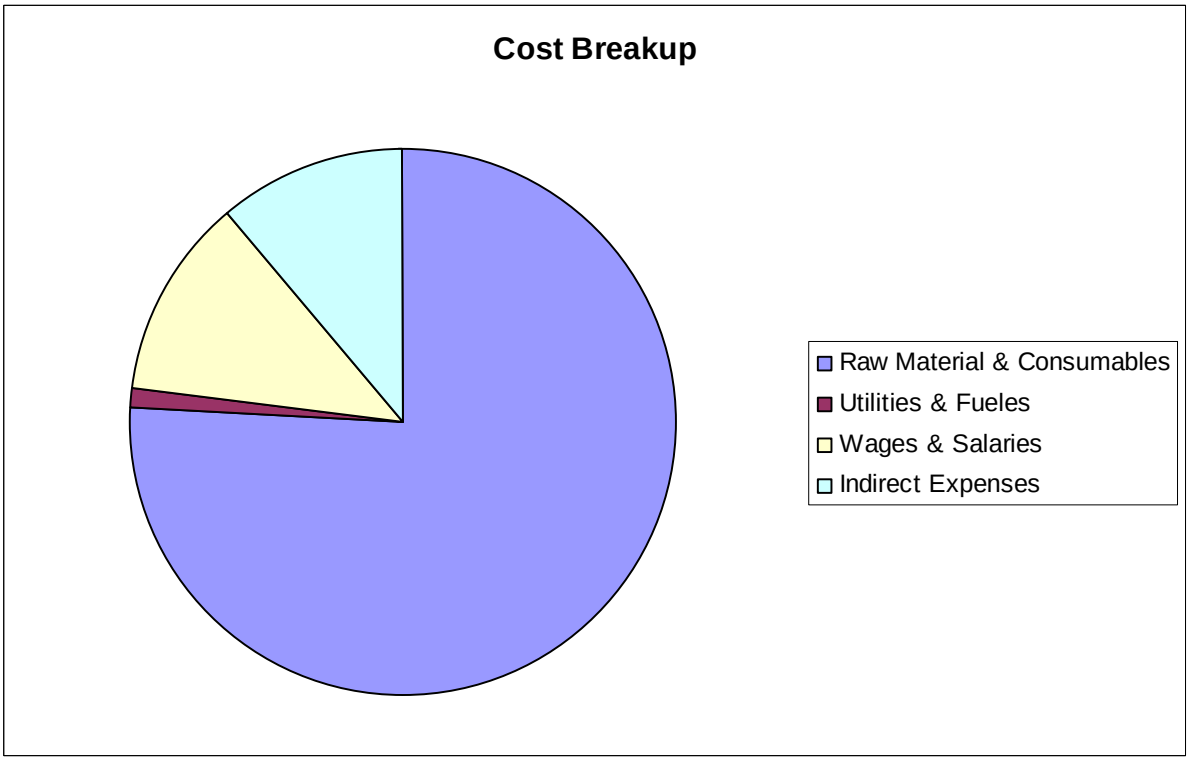
10.5 Cost of construction

Construction Cost	
Constructed Area (300 Sq. mtr. @ 6000per Sq. mtr.)	1800000
Shed (700 Sq. mtr. @ 3500 per Sq mtr.)	2450000
Total	**4250000**



10.6 Cost break up

Particulars	Amount (In lacs)
Raw Material & Consumables	419.00
Utilities & Fuel	7.55
Wages & Salaries	65.69
Indirect Expenses	61.30

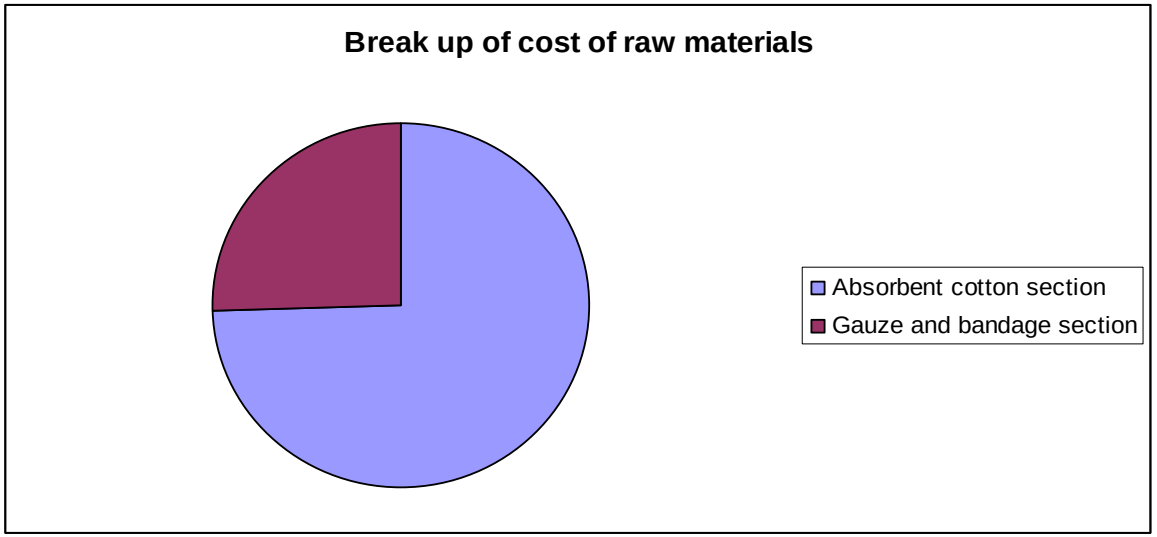


10.7 Expenses incurred

	Expenses (in Rs.)				
1	Salary and Wages				
	Type of Employees	No. of Employees	Per month	Per Annum	Total
	Manager	1	25000	300000	3
	Production Supervisor	2	15000	180000	3.6
	Office's Staffs and Marketing Executive	8	12000	144000	11.52
	Skilled Workers	15	10000	120000	18
	Unskilled Workers	25	7000	84000	21
	Total				**57.12**
	Perks		at 15%		8.57
	Total				**65.69**
2	Training and Development Cost (1% of Machinery)				0.67
3	Power (120HP @ .75per hour,80% utilization, 8hrs/day,25days/month)	Rate=1.45/unit	20880		2.51
4	Diesel, Water		42000		5.04
5	Selling Expenses (Publicity and Marketing Expense)	5% of Sales			29.5
	Total				**46.28**

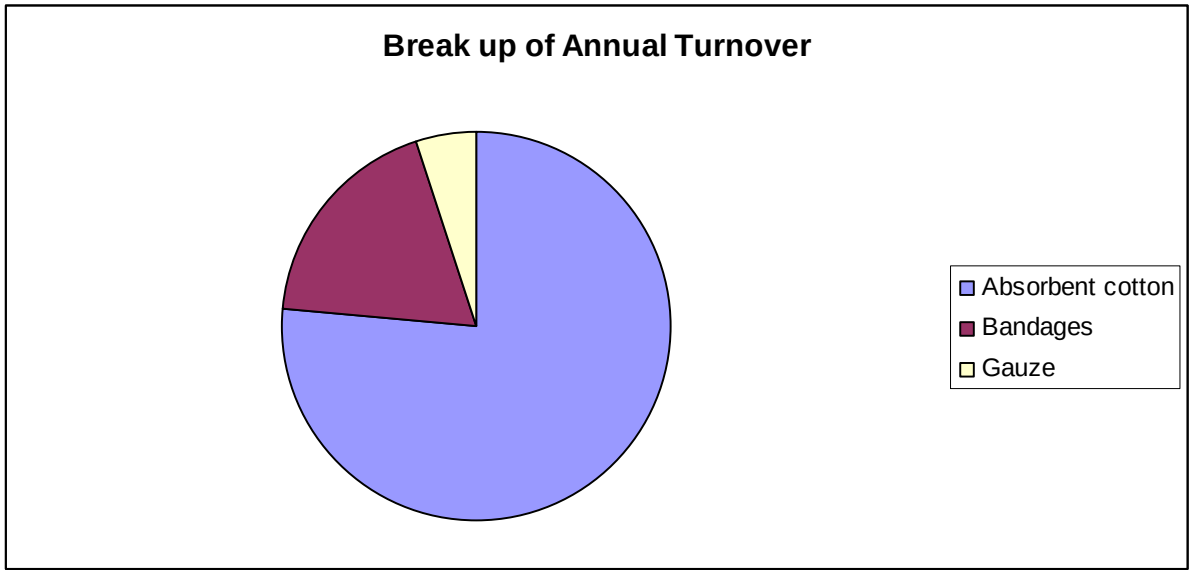
10.8 Cost of raw materials

Particulars	Amount
A) Absorbent Cotton Section	
RM-1	29,700,000
RM-2	360,000
RM-3	150,000
RM-4	90,000
RM-5	300,000
RM-6	600,000
Sub Total	**31,200,000**
B) Gauze and Bandage Section	
RM-1	9,600,000
RM-2	600,000
RM-3	500,000
Sub Total	**10,700,000**
Total	**41,900,000**



10.9 Annual Turnover

Annual Turnover				
Particulars	**Units**	**Rate**	**Total**	
Absorbent Cotton (kg)	300,000	150	45000000	
Bandages (Dozen)	1,350,000		11000000	
Gauze (rolls)	120,000		3000000	
Total	**1,650,000**		**59000000**	
	2062500			



10.10 Income statement

Income Statement											
Operating years		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Capacity											
Installed Capacity (Kg / Nos)		2062500.00	2062500.00	2062500.00	2062500.00	2062500.00	2062500.00	2062500.00	2062500.00	2062500.00	2062500.00
Capacity Utilisation		80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
PRODUCTION		1650000	1650000	1650000	1650000	1650000	1650000	1650000	1650000	1650000	1650000
Sales Revenue		590.00	590.00	590.00	590.00	590.00	590.00	590.00	590.00	590.00	590.00
Raw Material & Consumables		419.00	419.00	419.00	419.00	419.00	419.00	419.00	419.00	419.00	419.00
Utilities & Fueles											
Power		2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51
Water, Diesel, etc		5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04
Sub Total		7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55
Wages & Salaries		65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69
Factory Overheads		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
General Overheads		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Lease											
Land		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Estimated Cost of Production		500.38	500.38	500.38	500.38	500.38	500.38	500.38	500.38	500.38	500.38
Selling Expenses		29.50	29.50	29.50	29.50	29.50	29.50	29.50	29.50	29.50	29.50
Cost of Sales		529.88	529.88	529.88	529.88	529.88	529.88	529.88	529.88	529.88	529.88
EBITDA		60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12
Interest		14.82	12.97	11.12	9.27	7.41	5.56	3.71	1.85	0.00	0.00
Depreciation		8.82	8.82	8.82	8.82	8.82	8.82	8.82	8.82	8.82	8.82
PBT		36.47	38.32	40.17	42.03	43.88	45.73	47.59	49.44	51.29	51.29
Taxation		10.94	11.50	12.05	12.61	13.16	13.72	14.28	14.83	15.39	15.39
PAT		25.53	26.83	28.12	29.42	30.72	32.01	33.31	34.61	35.91	35.91

It would be seen from table above that the PBT in the 1st year of operation in Rs. 36.47 lacs which works out to be 6% of the total sales. In the 10th year, the %age of PBT would be 9%. Similarly PAT in the 1st year is Rs. 25.53 lacs accounting for 4% of total turnover. PAT in 10th would rise to 6%. These figures could vary depending upon change in tax structure.

10.11 Repayment and Interest schedule for loans

Repayment and Interest Schedule for Loans

									176.48	123.54	15.44241
Operating Years	1	2	3	4	5	6	7	8	9	10	
Rate of Interest	12%										
Loan (Outstanding)	123.54	108.10	92.65	77.21	61.77	46.33	30.88	15.44	0.00	0.00	
Interest	14.82	12.97	11.12	9.27	7.41	5.56	3.71	1.85	0.00	0.00	
Moratorium											
Repayment	15.44	15.44	15.44	15.44	15.44	15.44	15.44	15.44	0.00	0.00	
Closing Balance	108.10	92.65	77.21	61.77	46.33	30.88	15.44	0.00	0.00	0.00	

10.12 Depreciation

Depreciation

Operating Years		1	2	3	4	5	6	7	8	9	10
Machinery @10%		6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70
Construction Cost @5%		2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13
Total		**8.82**	**8.82**	**8.82**	**8.82**	**8.82**	**8.82**	**8.82**	**8.82**	**8.82**	**8.82**

10.13 Projected fund flow statement

Projected Funds Flow Statement

Sn		Construction Period	Operation period									
	Years	1	1	2	3	4	5	6	7	8	9	10
	SOURCES OF FUNDS											
	Equity	52.95										
	Debt	123.54										
	PBDIT		60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12
	Total Sources A	176.48	60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12	60.12
	APPLICATION OF FUNDS											
	Fixed Assets Purchase	129.33										
	Miscellaneous Fixed Assets	3.00										
	Increase in Current Assets	44.16										
	Repayment of Loan Payment		15.44	15.44	15.44	15.44	15.44	15.44	15.44	15.44	0.00	0.00
	Payment of Interest on Term Loan		14.82	12.97	11.12	9.27	7.41	5.56	3.71	1.85	0.00	0.00
	Taxation		10.94	11.50	12.05	12.61	13.16	13.72	14.28	14.83	15.39	15.39
	Total Application B	176.48	41.21	39.91	38.61	37.32	36.02	34.72	33.42	32.13	15.39	15.39
	SURPLUS/(DEFICIT) A-B	0.00	18.91	20.21	21.50	22.80	24.10	25.39	26.69	27.99	44.73	44.73
	OPENING CASH & BANK BALANCES		0.00	18.91	39.11	60.62	83.42	107.51	132.91	159.60	187.59	232.32
	CLOSING CASH & BANK BALANCES	0.00	18.91	39.11	60.62	83.42	107.51	132.91	159.60	187.59	232.32	277.05

10.14 Projected balance sheet

	Projected Balance Sheet											
Sn	**Description**	**Construction Period**	**Operati0on Period**									
		1	1	2	3	4	5	6	7	8	9	10
1.1	Equity	52.95	52.95	52.95	52.95	52.95	52.95	52.95	52.95	52.95	52.95	52.95
1.2	General Reserves		25.53	52.35	80.48	109.90	140.61	172.63	205.94	240.55	276.45	312.36
1.3	Debt	123.54	108.10	92.65	77.21	61.77	46.33	30.88	15.44	0.00	0.00	0.00
	Total Liabilities	**176.48**	**186.57**	**197.95**	**210.63**	**224.61**	**239.88**	**256.46**	**274.32**	**293.49**	**329.40**	**365.30**
2	**Assets**											
2.1	Gross Fixed Assets	132.33	132.33	132.33	132.33	132.33	132.33	132.33	132.33	132.33	132.33	132.33
2.2	Accumulated Depreciation		8.82	17.65	26.47	35.29	44.12	52.94	61.76	70.58	79.41	88.23
2.3	Net Fixed Assets	132.33	123.50	114.68	105.86	97.04	88.21	79.39	70.57	61.74	52.92	44.10
2.4	Working Capital Assets	44.16	44.16	44.16	44.16	44.16	44.16	44.16	44.16	44.16	44.16	44.16
2.5	Cash & Bank Balances	0	18.91	39.11	60.62	83.42	107.51	132.91	159.60	187.59	232.32	277.05
	Total Assets	**176.48**	**186.57**	**197.95**	**210.63**	**224.61**	**239.88**	**256.46**	**274.32**	**293.49**	**329.40**	**365.30**

10.15 Discounted cash flow

	Discounted Cash flow statement (Total Investment)											
	Construction Period		Operation Period									
Years	t=0	t=1	1	2	3	4	5	6	7	8	9	10
Inflows												
Net Cash Accruals After Interest & Tax			34.35	35.65	36.95	38.24	39.54	40.84	42.13	43.43	44.73	44.73
Less: Change in Working Capital			0	0	0	0	0	0	0	0	0	0
Add back financial Expenses			14.82	12.97	11.12	9.27	7.41	5.56	3.71	1.85	0.00	0.00
Terminal value												160
Total inflow			49.18	48.62	48.06	47.51	46.95	46.40	45.84	45.28	44.73	204.73
Outflows												
Investment	132.33	44.16										
Bridge Loan	0	0										
Total outflow	132.33	44.16										
Net Cashflow	-132.33	-44.16	49.18	48.62	48.06	47.51	46.95	46.40	45.84	45.28	44.73	204.73
IRR on Investment (%)	22%											
NPV (12% Discount Rate)	Rs. 100.39											
Pay Back Period												
	Discounted Cashflow Statement (Equity)											
Years	t=o	t=1	1	2	3	4	5	6	7	8	9	10
Inflows												
Net Cash Accruals After Interest & Tax			34.35	35.65	36.95	38.24	39.54	40.84	42.13	43.43	44.73	44.73
Less: Change in Working Capital			0	0	0	0	0	0	0	0	0	0
Less: Loan Repayment			15.44	15.44	15.44	15.44	15.44	15.44	15.44	15.44	0.00	0.00
Terminal Value												82
Total Inflow			18.91	20.21	21.50	22.80	24.10	25.39	26.69	27.99	44.73	126.73
Outflows												
Equity	39.70	13.25										
Total Outflow	39.70	13.25										
Net Cash Flow	-39.70	-13.25	18.91	20.21	21.50	22.80	24.10	25.39	26.69	27.99	44.73	126.73
IRR on Equity	34%											

The IRR on investment is 22% which is quite a positive indication about the financial health of the project because the cost of borrowing is 12%. Similarly IRR on Equity is 34% which again is a positive indicator. The NPV @ of 12% on investment is Rs. 100.39 lacs which is quite good for any investment.

10.16 Break Even Point and Sensitivity Analysis

	Break Even Point And Senstivity Analysis				
	Normal	Case1	Case2	Case3	Case4
Variable Cost (Rs. Lacs)					
Raw material & Consumable Stores	419.00	460.90	419.00	419.00	460.90
Utilities	7.55	8.30	7.55	7.55	8.30
Total Variable Cost	426.55	469.20	426.55	426.55	469.20
Average Variable Cost (Rs. / Thousand Litres)	25.85	28.44	25.85	25.85	28.44
Fixed Cost (Rs. Lacs)					
Wages & Salaries	65.69	65.69	72.26	65.69	68.97
Repairs & Maintenance	5.00	5.00	5.50	5.00	5.25
General Overheads	3.00	3.00	3.30	3.00	3.15
Lease charges	0.15	0.15	0.17	0.15	0.16
Financial Expenses	14.82	14.82	16.31	16.31	17.12
Depreciation	8.82	8.82	9.71	9.71	10.19
Total Fixed Cost (Rs. Lacs)	97.49	97.49	107.23	99.85	104.84
Average Fixed Cost (Rs. per Thousands Litres)	5.91	5.91	6.50	832.09	873.69
Average Selling Price	35.76	35.76	35.76	35.76	33.97
Project Break Even Point (t)	984075	1331553	1082483	1007947	1894757
Project Break Even	60%	81%	66%	61%	115%
Cash Break Even Point	895011	1211040	984512	909976	1710589
Cash Break Even	54%	73%	60%	55%	104%

Case 1 - 10% Increase in Variable Cost
Case 2 - 10% Increase in fixed Cost
Case 3 - 10% Increase in Project Cost
Case 4 - 10% Increase in Variable Cost and Fixed Cost
5% Increase in Fixed Cost
5% Dcrease in Selling Price

The project break even in normal case is 54% i.e. after achieving 54% of the Projected Turn Over the unit would be in be in the profit zone

10.17 Ratio Analysis

Ratio Analysis		
1	Return on Assets	14%
2	Return on Equity	48%
3	Debt-Equity Ratio	2.33%
4	Interest coverage Ratio	4

10.18 Foreign exchange implications

The foreign exchange requirement for the project would be only for the import of machines, equipments and accessories for a value of Rs. 50 lacs, during the setting up of the project. Approximately, Rs. 5 lacs worth of foreign exchange would be required for incidental expenses such as training, travel, etc. Additionally, there would be a requirement of Rs. 420 lacs per annum for the import of raw materials. Thus, the foreign exchange expenditures during first five years would be Rs. 2155 lacs. The foreign exchange saving in terms of import substitution would be around Rs. 2950 lacs during the first five years of operation of the project.

CHAPTER 11 – ECONOMIC ANALYSIS

11.1 Economic Rate of Return (ERR)

Economic Rate of Return is the interest rate at which the cost and benefits of a project, discounted over its life, and equal. ERR differs from Financial Rate of Return in that it takes into account the effects of factors such as Price Controls, Subsidies and Tax breaks from local government, to compute the actual cost of the project to the economy.

The economic rate of return also includes indirect benefits to the economy that are likely to be ploughed back to the investors, people, government and other government or non-government agencies, over a longer period of time.

11.2 Relevance of ERR to the project

This concept of ERR is more relevant for big projects involving large capital deployment. For small projects, like the project under consideration, there may not be significant difference between Financial Rate of Return and Economic Rate of Return, as, while formulating the project, factors like Price Controls, Subsidies and Tax breaks from local government and also socio-economic benefits, have not been taken into account.

11.3 Socio-economic impact of the project

As state above, the concept of ERR is not quite relevant for this project and the impact of the proposed unit would not be quite significant on the overall economic scenario of Bhutan. However, over a long time horizon and setting up of a number of similar units would result into following socio-economic benefits for the country.

- Indigenous production of absorbent cotton, gauze and bandages would lead to self-reliance for these items in the field of hospital supplies. This would also insulate the healthcare services from vagaries of external economies.
- Local production of absorbent cotton, gauze and bandages would lead to **import substitution** which would result in saving of foreign exchange. Setting up of more units to meet the requirement of hospital supplies would have a multiplier effect on foreign exchange saving.
- There are possibilities of export of these products to the eastern and north-eastern parts of India and other neighboring markets. This would lead to earning to foreign exchange for the country.
- There are not many medium and small scale units manufacturing units in Bhutan. Setting up of this unit would have a catalytic effect on growth of entrepreneurship in medium and small scale sector.
- The setting up of the project would lead to generation of direct and indirect employment, both for skilled and unskilled workers which would result into

economic upliftment of local population. This would also lead to upgradation of skills.

- There are employment opportunities in the project for persons with managerial, technical, financial and marketing capabilities. The employment of such people in the local industry would provide them an option to have an employment in private sector in Bhutan and also reduce the migration of qualified manpower.
- There would be revenue generation for the local government by way of excise, sales tax/VAT and income tax from the unit as well as from its promoters.
- Finally, the project would lead to enhancement of economic activities in the field of construction, transport of raw materials and finished goods, marketing and trade, repairs and maintenance, etc.

It is important here to mention that above benefits can only be listed but these cannot be quantified based on a single unit with in small investment. However, as mentioned above, if a number of such units in hospital supplies sector or any other sector of economy are setup, these would have a significant impact on overall economy of Bhutan.

ANNEXURE

Annexure I

List of Machinery Suppliers

A. Surgical Gauze and Bandages

1. **M/s Dadiwala Engg. Works**
   18, Industrial Area (DLF)
   Najafgarh Road
   New Delhi

2. **M/s Honest Machinery Works**
   Beri Wall Gali, Bara Hindu Road,
   Delhi

3. **M/s Reliance Engg. Works**,
   Municipal Industrial Estate,
   2nd Floor, Gate No. 60,
   West Baptist Road,
   Bombay-400008

B. Surgical Cotton

1. **M/s. National Machinery Manufacturers Ltd.,**
   PB No. 3, Thane – 300 601

2. **M/s. Ramesh Safe and Carding Works**
   Station Road, Panipat

3. **M/s. Machinery Manufacturers Corporation,**
   B-61, Circular Garden Road,
   Calcutta – 600 043

4. **M/s Gujarat Machinery Manufacturers Ltd.,**
   187, Worli, Mumbai - 400018.

5. **M/s APV Engg. Co. Ltd.,**
   Jessore Road, Calcutta (W.B.)

6. **M/s Vikas Chemicals,**
   Tilak Bazar,
   Delhi - 110 006

7. **M/s Rtex Spinmach Pvt. Ltd.**
   46, Krishna Gopal Complex,
   Nar Ahmedabad - 380025- INDIA

Ph: (079)-22205499

8. **M/s Ashok Singh Textiles**
17, III Phase, GIDC,
Vapi-3961 -INDIA
Ph: (0260) 2424774

9. **M/s Wooltex Machinery Corporation**
40, White House, Panchwati,
Ahmedabad - 380006 -INDIA
Tel: (079) 26465056

10. **M/s Charbhuja Impex**
640/19, Narottam Bldg., Kapasi
Ahmedabad-380002 -INDIA

11. **M/s Laxmi Textile Stores**
22/23, PUNMAJI ESTATE, Dhobighat, Shahpur,
Ahmedabad-380004 –INDIA

12. **M/s Premier Engineers**
Bldg. No. 4, Maharani Estate, Somnath Rd
Dabhel, Daman-396 -INDIA

13. **M/s Dallow Textile and Industrial**
Plot No.C1B-287/2, GIDC,
Umarg -INDIA

14. **M/s Mahalaxmi Silk Mills**
C-1B 24407, III Phase, GIDC,
Vapi-396195 -INDIA
Ph; (0260) 2424773

15. **M/s Shah Associates**
Denswood Compd Central Rd. No Opp.
Udhna Sangh Compl., Udhna
Surat-394210 -INDIA
Tel: (0261) 2278645

16. **M/s Wooltex Machinery Corporation**
40, White House, Panchwati,
Ahmedabad - 380006
Tel: (079) 26465056

Annexure II

List of Raw Materials Suppliers

1. **M/s Balaji Cotton Linter**
   101, Vaibhav Residency 1
   Shukla Nagar Char Rasta
   Vrundavan Park Society, Sama
   Baroda, Gujarat
   Tel: 91-265-278 3880

2. **M/s Plexus Cotton Limited**
   Cotton Place, 2 Ivy Street
   Birkenhead
   Wirral CH41 5EF
   United Kingdom
   Tel: +44 (151) 650 8888

3. **M/s Saranya Spinning Mills Private Limited**
   10/243 Thuraiyur Main Road,
   Ponneri (Post),
   Namakkal,
   Tamil Nadu

4. **M/s Grrapple Overseas**
   306 Abhishree Complex,
   Opp. Star Bazar,
   Nr. Jodhpur cross Road,
   Satellite, Ahmadabad – 380015
   Gujarat, India

5. **M/s LGW Limited**
   Narayanpur, P.O.-Rajarhat - Gopalpur, 24 Parganas (North)
   Kolkata - 700 136 West Bengal
   Phone : +(91)-(33)-25733423 / 25733313
   Fax : +(91)-(33)-25733990

Annexure III

List of lab testing equipment suppliers

1. M/s Imperial Lab Equipment
   Address: 109, Vardhman Plaza Tower, H-3, Netaji Subhash Place
   District Center, PitamPura, New Delhi, Delhi
   Phone(s): 91-11-65154406 / 42470203
   Fax(s): 91-11-27352924

2. M/s Scientific Engineering Corp
   Address: 3280, Arya Pura Old Subzi Mandi, Delhi – 110007
   Phone(s): 91-011-23829918 / 23823794
   Mobile: 9811569035
   Fax(s): 91-011-23829918 / 23823794

3. M/s Toshniwal Brother Pvt. Ltd.
   388 Udyog Vihar Phase 3
   Gurgaon – 122006
   Haryana
   Ph +91-124-4003629 / 4003985
   Fax no +91-124-4003986