3.1 INTRODUCTION TO PAPER INDUSTRY:

It is fact that paper is inevitable for the development of human race, and the economy of country. Hence the paper industry of any country plays vital role. In this chapter how the present material form of paper has come into existence, how they worked paper industry is, the role of Indian paper industry and that of Tamilnadu are explained.

The origin of paper goes to the early Egyptian civilization. The Egyptians used the stalks of the papyrus plant to manufacture a material resembling paper. Several changes have been made and many new materials have been used in the paper making process, but base of most papers is still fiber form plant.

3.2 HISTRICAL DEVELOPMENT OF PAPER INDUSTRY IN THE WORLD

Paper making can be traced to about 105 AD, when T’Sai Lun, an official in the imperial court of China created a sheet of paper using mulberry and other bast fibres along with fishnets, old rags and hemp waste. In its slow travel westward, the art of papermaking reached Samarkand, in central asia, in 751 AD and in 793 AD the first paper was made in Baghdad during the time of Harunat-Rashid, with the golden age of

---

Islamic culture that brought papermaking to the frontiers of Europe. In the 10th century, Arabians substituted linen fibres and bamboo to create finer sheet of paper. By 12th century, paper making reached Europe. Johannes Gutenberg invented printing machine in 1448 which led to rapid increase in demand of paper. The first successful paper machine was built by JLN Robert in 1798. Thereafter, papermaking underwent revolutionary changes, when several major pulping processes were gradually developed, which relieved paper industry of its crucial dependence upon cotton and linen rags. The origin and development of paper industry is segregated in five stages and presented in the following table:

**TABLE NO.3.1**

**PAPER INDUSTRY – DEVELOPMENTAL PHASES**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Period covered</th>
<th>Development Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>1800-1860</td>
<td>• Mechanization – rage preparation, use of filler, pulp beating and paper machine</td>
</tr>
</tbody>
</table>
| Second | 1840-1880      | • Industrial scale rage substitute (ground wood/chemical pulp)  
• Appropriate pulp mills were developed |
| Third  | 1860-1950      | • Enlargement of web width - 85 to 770cm  
• Increase in production speed - 5 mpm to 500mpm  
• Introduction of electric drive  
• Machines to produce particular type of paper |
| Fourth | 1950-1980      | • Further increase in web width and working speed, use of new materials (TMP, dinked paper, new filler, chemicals and dyes), new sheet forming (twin wire formers) etc. |
| Fifth  | 1980 onwards   | • Leads into future  
• Evolution of new sheet forming principles and chemical pulp processes |
3.3 VARIOUS PAPER PRODUCTS:

3.3.1 TYPES OF PAPERS PRODUCED IN PAPER INDUSTRY

There are different types and grades of paper for different uses, which are often reflected in their names. Coated text and cover are used for the majority of four-color printing. Uncoated text and cover are also used regularly. Bond, book, offset, label, index, and news-print are some of the other grades used commercially. Paper choice can make a major difference in the appearance of the finished job. A dull or plain design can be perked up with an exciting color or texture.

a) Coated Papers

It is best suited for higher-quality jobs. Coated papers may be gloss-coated, dull-coated, machine-coated, and cast-coated on one or both sides. Printing ink does not soak into a coated sheet as much as it does with an uncoated paper. So, coated papers can make halftones and color images look richer. Coated papers are associated with corporate capability brochures and annual reports. Since coated papers come in several grades and prices, user should not have to shy away from using them. Today, more and more coated papers are recycled, which also lowers their costs.

b) Uncoated Papers

Uncoated papers are also known as text. These papers can be excellent sheets for printing. Some uncoated papers are so smooth that it's hard to tell that they're not coated. Uncoated papers are manufactured in
many textures and colors. Uncoated papers are used for halftones, when the
designer is trying to achieve a certain effect or look.

c) Bond

It is often used for stationery. It takes ink well from a laser printer or
a pen. Part of this absorbency comes from the paper's rag content, which is
the percentage of cotton fiber in a sheet of bond. Twenty five per cent or 50
percent is the usual amount added.

d) Note Book Paper

It is used, for books and textbooks. These papers come in antique or
smooth finishes. They also come in many weight so that a book can be
bulked up or down.

e) Offset Papers

It is similar to the coated and uncoated sheets. It resists the moisture
that occurs in offset printing.

f) Index Papers

It is stiff. It takes writing ink well. Index papers are less expensive
than cover grades. Index papers are used for cards or tabs and are also used
in place of the more expensive cover stocks. They come in a smooth or
vellum finish.
g) Newsprint Papers

As their name suggests, they are used for newspapers. The sheets are not as white as other papers. Ink tends to soak into them. Being relatively inexpensive, newsprint is ideal for the large volumes of paper that modern newspapers need.

h) Computer Paper

This is the general term used to describe paper used in a computer. It can also refer to paper used with a copier or for a laser printer. Although the “fan-fold” paper was probably the Copier Paper, or just plain bond paper. This is because of the move from the dot-matrix printer to the laser and inkjet printers. If so, take a look below for some valuable information that may help you in your search.

i) Copier Paper

It is standard paper used for copies. It is 20 per grams square meter, thin and somewhat transparent. Copier Paper has many different properties that affect the quality of the copies. White Point - Contrast is a key element between the toner and the paper. The whiter the paper the better your copies, Texture- The smoother the paper, the better the toner transfers to it. Smoother paper gives sharper copies and better fills. Smooth paper, however, can sometimes be difficult to feed.
j) Coating

Coating paper needs some type of clay or dust coating to help the paper separate and feed it. Most copier paper will have some type of indicator to show which side should be copied on.

k) Gloss Paper

It is ideal for photographic images, posters and printing of graphic designs. Matte Paper -is a high resolution bright white coated paper. Ideal is for everyday printing and it features superior drying properties.

l) Picture Paper

It is water resistant. It dries spontaneously for easy handling. This inkjet paper, in the popular 4” x 6” format, is ideal for consumer use.

m) Inkjet Paper

If the task is a printing of a document an email or memo, plain copier paper will work best. If color is important, then coated paper stock is preferred. Coated paper allows colors to be sharper than regular copier paper. A high level of coating allows for a high print resolution from 600 dpi -1440 dpi. There are many different types of paper available. But, only coated papers designed specifically for inkjet printers, will give the highest quality output.
The product segments in the paper industry can be broadly classified as newsprint, printing and writing paper, industrial paper and specialty papers. Based on the primary raw material used, the companies in the paper industry are categorizing into wood based, agro based and waste paper based companies.

Some of the paper products are sheet paper, paper boxes, tissues, paper bags, stationery, envelopes, and printed-paper products such as books, periodicals, and newspapers. Specialty papers like sandpaper, blueprint paper, carbon paper are not a part of paper products industry. Stationery includes greeting cards, printing and writing papers, school and office papers. The toiletry products include paper towels, tissue paper, and bath tissue.

3.3.2. VARIOUS TYPES OF PAPER INDUSTRY:-

a) Wood Based industry

Forest policy should be revised with a view to raising plantation by industry/Cooperatives of farmers/State Government.

b) Waste Paper based Industry

Introduction of ecolabeling system wherein products made from recycled fibre, are rated higher than the products made from virgin fibre.
c) **Agro Based Industry**

Funds are made available for technology up-gradation for handling and processing of agro residue fibre, in small and medium scale industries.

### 3.4 WORLD PAPER INDUSTRY

Although modern inventions and engineering have transformed an ancient craft into a highly technical industry, the basic operations in papermaking remain the same to this day. The steps in the process are as follows:

1. Suspension of cellulose fibre is prepared by beating it in water, so that the fibres are thoroughly separated and saturated with water;
2. The paper stock is filtered on a woven screen to form a matted sheet of fibre;
3. The wet sheet is pressed and compacted to squeeze out a large proportion of water;
4. The remaining water is removed by evaporation;
5. Depending upon the use and requirements, the dry paper sheet is further compressed, coated or impregnated. The differences among various grades and types of paper are determined by the type of fibre or pulp, the degree of beating, the addition of various materials to stock, formation conditions of the sheet, including basis weight, or substance per unit are, and the physical or chemical treatment applied to the paper after its formation.

Government has completely delicensed the paper industry with effect from 17th July, 1997. The entrepreneurs are now required to file an Industrial Entrepreneur Memorandum with the Secretariat for Industrial Assistance for
setting up a new paper mill or substantial expansion of the existing mill in permissible locations.99

The new millennium is going to be the millennium of knowledge. So demand for paper would go on increasing in times to come. In view of paper industry's strategic role for the society and also for the overall industrial growth, it is necessary that the paper industry performs well. The Paper industry is a priority sector for foreign collaboration and foreign equity participation up to 100 percent receives automatic approval by Reserve Bank of India. Several fiscal incentives have also been provided to the paper industry, particularly to those mills which are based on non-conventional raw material.

Global production of paper and paper board was around 350 million tons which contributes to about 3.5 percent of world’s Industrial production and 2 percentage of world’s trade. India was ranked 15th in the World in terms of paper and boards production capacity.

The world paper industry was growing at a CAGR (Compound Annual Growth Rate) of 2.8 percent with a per capita consumption of 45 Kilograms. The per capita consumption is 152 Kilograms in developed countries and 12 Kilograms in developing countries and in India it is around 6 Kilograms.

The per capita consumption of paper in Asian countries is shown in Table No.3.2.

TABLE NO. 3.2
PER CAPITA CONSUMPTION OF PAPER IN VARIOUS COUNTRIES
(as on march 2008)

<table>
<thead>
<tr>
<th>Country</th>
<th>Production (Million)</th>
<th>Consumption (million tons)</th>
<th>Consumption per capita (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>31.828</td>
<td>31.736</td>
<td>250</td>
</tr>
<tr>
<td>China</td>
<td>30.900</td>
<td>36.277</td>
<td>28</td>
</tr>
<tr>
<td>Korea</td>
<td>9.308</td>
<td>7.385</td>
<td>156</td>
</tr>
<tr>
<td>Indonesia</td>
<td>6.935</td>
<td>3.911</td>
<td>19</td>
</tr>
<tr>
<td>Taiwan</td>
<td>4.500</td>
<td>5.110</td>
<td>229</td>
</tr>
<tr>
<td>India</td>
<td>5.260</td>
<td>5.220</td>
<td>5</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.466</td>
<td>2.114</td>
<td>34</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1.078</td>
<td>2.251</td>
<td>101</td>
</tr>
<tr>
<td>Philippines</td>
<td>0.750</td>
<td>0.828</td>
<td>11</td>
</tr>
<tr>
<td>Vietnam</td>
<td>0.389</td>
<td>0.570</td>
<td>7</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>0.190</td>
<td>1.041</td>
<td>151</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.052</td>
<td>0.577</td>
<td>160</td>
</tr>
</tbody>
</table>

Source: Metso paper 2008

The paper industry is estimated to contribute about from 2,000 to 2,500 crores to the national exchequer by way of excise duty and sales tax. Indian paper industry reported a volume growth of about 6 percentage in 2007-08 in line with GDP growth. Low domestic per capita consumption of paper is 6 Kilograms. The paper market in India is in a ‘catch up’ phase with growth rate more than twice the world’s average.
3.4.1 GLOBAL COMPETITIVENESS

With India becoming a member of World Trade Organization, it has become important for the Indian industry to develop a strategy to become globally competitive. During the phase of industrialization after independence, the immediate focus of this industry was essentially on growth and expansion. In a regulated market under a mixed economy, it had developed a feeling of complacency. For a long time, it often compromised quality, perhaps due to monopolistic conditions in a closed market scenario. Indeed, for several decades, a major part of the Indian paper industry never really came to attach significance to terms such as market forces, economy of scale, quality and customer satisfaction.

Demand of Paper has been around 15 per cent. During the years 2006-09. While newsprint registered a growth of 13 per cent, Writing and Printing paper, Container board, Carton board and others registered growth of 5 per cent, 11 per cent, 9 per cent and 1 per cent respectively. So far, the growth in paper industry has mirrored the growth in GDP and has grown on an average 6-7 per cent over the last few years. The futuristic view is that growth in paper consumption would be in multiples of GDP. Hence, an increase in consumption by one kg per capita would lead to an increase in demand of 1 million tons.

As per the estimation of industry, paper production is likely to grow at a CAGR (Compound Aggregate Growth Rate) of 8.4 per cent where as paper consumption will grow at a CAGR of 9 per cent till 2012-13. The import of pulp & paper products is likely to show a growing trend. During last few years, the Indian paper market witnessed a five-fold jump in the
import of coated paper. The total import of this paper rose to 10,000 tons in 2008.\(^{100}\)

### 3.5 PAPER INDUSTRY IN INDIA

In India, first machine-made paper was manufactured in 1812. During this time there were 15 mills with a total production of lakh tones. In India the soft wood is the principal raw material used for making paper especially newsprint and high class printing papers. With rise in population and broadening of education, the demand for paper has been constantly escalated. Owing to very narrow forest resources, wood pulp is in a shortage. As soft woods grow in temperate climate, India is in short supply of such woods. Thus, in such circumstances, the Bamboo became the major raw materials for the manufacture of paper in the country as it grows very quickly even after cutting

Paper industry primarily depends upon forest-based raw materials. The first paper mill in India was set up at Sreerampur, West Bengal, in the year 1812. It uses grasses and jute as raw material. Large scale mechanized technology of papermaking was introduced in India in early 1905. Since the raw material for the paper industry underwent a number of changes over a period of time, wood, bamboo, and other non-conventional raw materials have been developed for use in the papermaking. The Indian pulp and paper industry at present is very well developed and established. Now, the paper industry is categorized as forest-based, agro-based and others (waste paper, secondary fibre, bast fibres and market pulp).

\(^{100}\) [http://www.ipma.co.in/paper_industry_overview.asp](http://www.ipma.co.in/paper_industry_overview.asp)
In 1951, there were 17 paper mills but, today there are about 400 units engaged in the manufacture of paper, paperboards and newsprint in India. The pulp and paper industries in India have been categorized into large-scale and small-scale. Those paper industries, which have the capacity of above 24,000 tonnes per annum, are designated as large-scale paper industries. India is self-sufficient in manufacture of most varieties of paper and paperboards. Import is confined only to certain specialty papers. To meet part of its raw material needs, the industry has to rely on the imported wood pulp and waste paper.\(^{101}\)

Growth of paper industry in India has been constrained due to high cost of production caused by inadequate availability and high cost of raw materials, power cost and concentration of mills in one particular area. Government has taken several policy measures to remove the bottlenecks of availability of raw materials and infrastructure development.

India is facing era of profound economical change. Economic liberalization and reduced import duties for paper as well as paper product has triggered a significant restructuring in the India pulp and paper industry. The domestic supplier’s ability to meet the rapidly growing demand of printing industry of paper product is limited by the high quality fiber shortage and also technology gap prevailing in India. Securing the fiber supply is an important precondition for the growth of the domestic pulp and paper industry. Surging environmental awareness and concern with mounting economic limitation has forced many mills not available in the dynamic market environment. The shift from small to medium and large

scale operation has become important due to the erosion of important tariff barriers and consequent supply pressures from abroad. The changing market scenario made paper manufacturers to rethink and plan the strategies to sustain future markets. The industry has to respond with a challenge to the change in situation prevailing in paper market.

3.5.1. POSITION OF INDIAN PAPER INDUSTRY:

Paper industry in India is the 15th largest paper industry in the world. It provides employment to nearly 1.3 million people and contributes Rs.25 billion to the government's kitty. The government regards the paper industry as one of the 35 high priority industries of the country.

India’s population is forecast to grow from 923 million in 1994 to 1.23 billion by 2010, corresponding to an average long term growth rate of 1.8 per cent the literacy rate in India has been sturdily growing (52 per cent) in 1995 to at least 70 to 75 per cent during next ten years. The average GDP growth is expected to remind at beyond 8 to 9 per cent per annum in the next 5 to 10 years and for every increase of one per cent in GDP paper demand increases by one lakhs tones annually. The Indian paper industry is highly fragmented with the capacity of paper mills ranging from 3300 tons per annum to 2 lakhs tons per annum

It is estimated that 400 paper mills are in India with total capacity about 51 lakhs tpa (1999-2000). Of the total effective capacity of 51 lakhs tons per annum 39 per cent is accounted for wood based units. And 32 per cent by agro residual based mills. The total supply in the country including all grades from organized sector was about 28.3 lakhs tones in 1994-95 and 38.8 lakhs during 1999-2000.
Generally speaking, per capita consumption of paper is a measure of standard of living. Business activity, personal sending power and advertising are the main engine behind paper consumption in the earth requirements for packaging boards, business papers and advertising media. With the increasing literacy levels and per capita income, the demand for all grades of paper will have a growth rate of 7 per cent. If the demand continues, they should reach at 51 lakhs tones by 2010-2011 as shown below:

**TABLE NO. 3.3**

**DETAILS OF PAPER DEMAND AND PRODUCTION IN INDIA**

(in thousand tones)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Demand by 2010-2011</th>
<th>Production 2008-2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printing and writing</td>
<td>1688</td>
<td>1530</td>
</tr>
<tr>
<td>Industrial packaging</td>
<td>2093</td>
<td>1577</td>
</tr>
<tr>
<td>News print</td>
<td>1094</td>
<td>613</td>
</tr>
<tr>
<td>Others</td>
<td>172</td>
<td>130</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5047</strong></td>
<td><strong>3850</strong></td>
</tr>
</tbody>
</table>

**Source:** Indian Pulp & Paper Technical Association Industrial Directory - 2010

There are many conjectures about the arrival of paper industry in India. The general view often expressed is that Muslims came into eastern India from china via. Nepal. One has to examine critically whether former view is not due to the preponderance of Muslim sources and lack of tradition for documentation in others in the east the manuscript evidence begins from
the 12th century onwards and these are non-Muslims libraries. in both eastern and western India, Hindu, Buddhist and Jain manuscript libraries made extensive use of papers. But only after Muslim conquest of India, records of invention, use and manufacture of paper are scant in non-Muslim sources.

Indian Paper Industry accounts for about 1.6 per cent of the world’s production of paper and paperboard. The estimated turnover of the industry is Rs 25,000 crore, and its contribution to the exchequer is around Rs. 2918 crore.

Demand of paper has been around 15 per cent. During 2006-09, newsprint registered a growth of 13 per cent. Newsprint and publication paper consumption account for 2 million tonnes, of which 1.2 million tonnes of newsprint paper is manufactured in India and the remaining 0.8 million tonnes is imported.

The industry provides employment to more than 3 million people directly and another 1 million people indirectly.
## TABLE NO. 3.4
**DETAILS OF PAPER MILLS IN INDIA**

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>NAME OF THE STATE</th>
<th>NUMBER OF PAPER MILLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Andra Pradesh</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Assam</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Bihar</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Chandigarh</td>
<td>7</td>
</tr>
<tr>
<td>5.</td>
<td>Delhi</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Gujrat</td>
<td>52</td>
</tr>
<tr>
<td>7.</td>
<td>Haryana</td>
<td>14</td>
</tr>
<tr>
<td>8.</td>
<td>Himachal Pradesh</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>Jammu</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>Karnataka</td>
<td>19</td>
</tr>
<tr>
<td>11.</td>
<td>Kerala</td>
<td>10</td>
</tr>
<tr>
<td>12.</td>
<td>Maharashtra</td>
<td>59</td>
</tr>
<tr>
<td>13.</td>
<td>Nagaland</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>Orissa</td>
<td>5</td>
</tr>
<tr>
<td>15.</td>
<td>Pondichery</td>
<td>6</td>
</tr>
<tr>
<td>16.</td>
<td>Punjab</td>
<td>35</td>
</tr>
<tr>
<td>17.</td>
<td>Rajasthan</td>
<td>6</td>
</tr>
<tr>
<td>18.</td>
<td>Tamil Nadu</td>
<td>27</td>
</tr>
<tr>
<td>19.</td>
<td>Ujjaini</td>
<td>1</td>
</tr>
<tr>
<td>20.</td>
<td>Utradinakpur</td>
<td>1</td>
</tr>
<tr>
<td>21.</td>
<td>Utranchal</td>
<td>3</td>
</tr>
<tr>
<td>22.</td>
<td>Uttar Pradesh</td>
<td>57</td>
</tr>
<tr>
<td>23.</td>
<td>Uttarkand</td>
<td>9</td>
</tr>
<tr>
<td>24.</td>
<td>West Bengal</td>
<td>14</td>
</tr>
</tbody>
</table>

3.5.2 PAPER INDUSTRY AFTER ECONOMIC REFORMS

With liberalization, the industry is thrown open to competition from mills abroad without providing a level field. Shortage of fiber supply, high cost of energy and old technology has plagued the industry. The three years ending with the financial year 2005-2006 has been extremely difficult for the paper industry. In the domestic market, the supply outstripped the demand. Improved newsprint was available at rock bottom prices. Domestic newsprint prices have been rolled back by 30 per cent. As the prices in the international market were ruling low, export of printing and writing from the country also dwindled down. Even now the industry is under the grip of several recessions.

Now, with the global economic slowdown, the demand for newsprint has started declining from January 2001. Consequently, the prices in the international have become soft since January 2001. This has begun to affect the price in the domestic market. Over supplying Asia has also affected the printing and writing papers segment since January 2001. Unlike in the past when a market downturn would seriously impact its profitability, the mills can do reasonably well by cost reduction of imported pulp and flexibility in product mix.

The last decade of the twentieth century will certainly be characterized as one of accelerating globalization. Although individual countries and regions of the globe experience change and react to it in unique ways, it is clear that they are becoming increasingly interdependent. Corporations are becoming more and more multinational through expansion, mergers, and acquisitions. Trade barriers are falling away. Public policy issues, notably
those concerning environment, are having worldwide impact, democratization is changing social and political patterns in the direction of increased co-operation and accord. The pulp and paper industry worldwide is dearly a participant and is profoundly affected by these changes. An international perspective is essential today, both in developing longer term strategy and in making shorter term business decisions.

The Indian paper industry presents a unique picture, with a mix of large and small paper mills, having capacities ranging from 5 to 600 tonnes per day, with an average size of 11,500 tonnes per year. There are more than 400 pulp and paper mills produce nearly 6.2 million tonnes per year of paper and board as against its installed capacity of 8.6 million tonnes. The industry has a turnover of more than Rs.25000 Crore, employing nearly 3,00,000 people directly and another one million indirectly.

But in the wake of the economic liberalization, triggered by the new economic policy of the government in 1991, the Indian paper industry found itself confronted with international competition. Almost overnight, the industry was exposed to the difficult task of integrating into the global economy. This also had an evolutionary effect on the traditional Indian management style, triggering a serious redesign of strategies to ensure survival. Today, the concept of globalization, eco-cycle compatibility and other environmental issues are being integrated at the planning level by the major domestic players.

Among the above three segments of the Indian paper industry, the forest-based pulp and paper industry is slowly moving towards competitiveness through adequate modernization. However, a significant
proportion of this segment has yet to undertake modernization programs. Areas identified for technological improvement in these mills include the installation of oxygen delignification for low kappa pulp and improved online control of stock preparation and paper machines.

In the agro-residue-based segment, there are a few mills complying with quality and environmental requirements. Furthermore, the majority of units do not have the proper technology to produce good quality products at a competitive price. This segment is also having serious environmental problems due to the lack of chemical recovery systems.

Major portions of this segment require modernization to become competitive. Upgrading pulp washing systems to reduce the organic carryover to the bleach plant, extracting the maximum amount of chemicals (addition of extra rotary drum washer) and building a common chemical recovery plant for a cluster of mills have been identified as the main technological initiatives needed.

The third segment, recycled fibre, also has a number of small pulp and paper mills that are based on obsolete technology. One of the major concerns of these mills is a lack of adequate equipment for processing recycled fibre. As a consequence, the quality of paper products produced from these mills does not conform to international standards. The competitiveness of this segment without modernization would be poor. Among the areas identified for improvement in this sector are upgrades of secondary fibre processing systems and the installation of a common effluent treatment plant for a cluster of mills.
In a vibrant, growth-oriented economy, the demand for paper is expected to be increasing, which in turn is expected to foster growth in the Indian paper industry. Pressure for technological improvements is also closely tied to demands for greater environmental responsibility in the country. The industry has to comply with the Charter on Corporate Responsibility for Environmental Protection (CREP) wherein the emission limits have already been fixed for the future.

3.5.3. PROBLEMS AND ISSUES OF INDIAN PAPER INDUSTRY

The Indian paper industry faces the following problems

(1) Non-availability of good quality of raw materials:

It is obvious that a right combination of pulp and paper markets and wood raw materials is a prerequisite for developing new industries and establishes a basis for selecting the type and size of the development. While domestic or regional markets in the tropical countries are often relatively limited and can support a type and size of plant which would not be internationally competitive, these markets are often protected and can in some cases accept products which are not of the best quality. To be competitive on international markets, pulp and paper development normally needs large quantities of wood at relatively low cost. The type and quality of wood which a pulp and paper mill can use from the technical point of view and the price the mill can afford to pay for the wood vary widely depending on the market. The three basic and most important questions regarding the feasibility of using wood for pulp and paper production are thus:
1. Markets for products,
2. Type and quality of wood,
3. Quantity and cost of wood.

Forecasting future markets is a well-established and relatively simple procedure which needs no further discussion within the scope of this paper. Classifying the wood to be either coniferous or broad-leaved type is sufficient to indicate the broad pulp and paper categories for which it can be used. Regarding quality, an extremely important factor is uniformity of wood in terms of uniform density and uniform fibre dimensions. Other factors affecting quality are hemi-cellulose, extractive and parenchymatic and vessel cell contents in the wood. It should be noted that, while the softwood species have a wider and more versatile use for pulp and paper products than hardwood species, long-fibred softwood cannot be said to be of better quality than short-fibred hardwood without specifying for what product the wood is used and without considering product quality requirements and economics of operation.

(2) Lack of modernization and basic infrastructure:

This point explains the investments in modernization and innovation on productivity in a sample of firms in the global pulp and paper industry. This industry is important because it has traditionally accounted for significant amounts of employment and capital investment. In contrast to much of the existing literature which focuses on the impact of R&D and patents on firms’ performance and productivity, actual investment transactions in four main areas of operations such as mechanicals, chemicals, monitoring devices and Information technology.
We find that firms which made decisions to implement a greater number of investment transactions in modernization achieved higher productivity, and these estimated quantitative effects are greater than the impact of standard innovation variables such as patents and R&D.

3. Increased emerging environmental issues

a) Deforestation

Worldwide consumption of paper has risen by 400% in the past 40 years, with 35% of harvested trees being used for paper manufacture. Logging of old growth forests accounts for less than 10% of wood pulp, but is one of the most controversial issues. Plantation forest, from where the majority of wood for pulping is obtained, is generally a monoculture and this raises concerns over the ecological effects of the practice. Wood chipping to produce paper pulp is a contentious environmental issue in the world.

b) Air pollution

Nitrogen dioxide (NO₂) sulfur dioxide (SO₂) and carbon dioxide (CO₂) are all emitted during paper manufacturing. Nitrogen dioxide and sulfur dioxide are major contributors of acid rain, whereas CO₂ is a greenhouse gas responsible for climate change.

c) Water pollution

Waste water discharges for a pulp and paper mill contains solids, nutrients and dissolved organic matter, and unless at low levels these are classed as pollutants. Organic matter dissolved in fresh water, measured
by Biological Oxygen Demand (BOD), changes ecological characteristics, and in worse case scenarios leads to death of all higher living organisms..

(3) Resource Development

The problem of practice described in this paper is a resource allocation problem in innovation. And how make resource allocation decisions in Research and Development. More specifically, the paper will investigate contextual patterns as to when organizations rely on markets versus hierarchies in technological innovation. Based on the taxonomy of the decision making process, this paper will describe trajectories along which economic entities make resource allocation decisions and suggest a framework linking decision making variables with strategic considerations. Currently companies face pressures not only from the customers and competitors but also from other agents of the distribution channel such as retailers and wholesalers. In this situation, companies are trying to differentiate themselves from domestic and international competition through innovation, branding and product marketing. However, decisions in innovation are becoming more complex since new technologies involve high risk and uncertainty. Moreover, consumer expectations have continuously risen and continue to challenge manufacturers in the area of product cost, speed to market, and innovative feature sets. The question that professionals like how to innovate in an environment that is shaped by high uncertainty and volatility, where suppliers and collaborators can become competitors and vice versa. Moreover, these situations are subject to the opportunistic behavior of the economic agents. Moreover, companies talk about core competencies in a competitive world.
3.5.4 PAPER MANUFACTURE CENTRES IN INDIA

With the rapid demand of writing materials, the paper making centres were established in different parts of the country like in Sialkot (Punjab); Zafarabad in district Jaunpur (Oudh); Bihar Sharif in district Azimabad (Patna) and Arwal in district Gaya (Bihar); Murshidabad and Hooghly (Bengal); Ahmedabad, Khambat and Patan (Gujarat); and Aurangabad and Mysore in the south.

• Out of these, the Punjab was the leading centre. Sialkot paper was white in colour and very thick. It was used throughout Punjab.

• In Uttar Pradesh, Zafarabad is a famous town in Jaunpur district. It was known as Kaghdi Shahar (paper city) in olden times. It produced a very fine, glossy and strong variety of bamboo paper. Generally, two varieties of paper were produced here. The first was the polished paper, which was exceedingly glossy, and the second was unpolished paper.

• Bihar had two major papermaking centers in medieval times. The first was Arwal town in district Gaya, and the second was Bihar Sharif in district Azimabad (Patna).

• In Bengal, Murshidabad and Hooghly were the major papermaking centers in the medieval times. At a later period, Dinajpur also started manufacturing paper.

• After some time, Gujarat developed as the largest producer of paper. It supplied paper to the rest of India and also exported it to the West, other Asian countries and Turkey also. In Gujarat, Ahmedabad was the largest papermaking centre. It produced white and glossy paper.
During the Mughal period, Daulatabad, having Aurangabad as its capital, emerged as an important papermaking center. The most remarkable feature of Daulatabadi paper was its durability and glossiness. Daulatabad was the chief supply centre of paper to south India.

Tipu Sultan developed papermaking centres in Mysore. The paper produced by Mysore was a high quality paper, which was employed only for royal use.

Other big paper making centres of medieval India were: Sanganer (in Jaipur, Rajasthan), Kotah (Rajasthan), Tijarah (in Alwar, Rajasthan), Kannauj (in Farrukhabad, Uttar Pradesh), Kalpi and Pukharayan in Kanpur (Uttar Pradesh), Maler-Kotlal (Punjab), Hariharganj(in district Shahabad, Bihar), Kalita (in district Pabna, now in Bangladesh), Panchamnagar (in district Damoh, Madhya Pradesh), Dharangaon and Erandel town (in district East Khandesh, Maharashtra) and Poona.

Generally Indian papermaking centres produced glazed paper. Rahman has categorized ancient paper into seven categories: Kashmiri, Ahmedabadi, Hyderabadi, Faizabadi, Khasah-i-Jahangiri, Kanpuri and Aurangabadi.

Ahmedabadi paper was a little thick and was of two qualities: fine and superfine. The paper had extra whiteness and glossiness.

Kashmiri paper was thick and glazed. Some Kashmiri centres produced superfine paper called silken paper.

Khasah-i-Jahangiri paper was made at Sialkot. The paper was glossy, thin, polished and bluish white.
Hyderabadi paper was well glazed; some was polished and of brown colour with very fine shades.

Faizabadi paper had three varieties: i) unpolished paper (medium quality); ii) pale yellow; and iii) polished dark yellow.

Kanpuri paper was prepared from bamboo and was greyish in colour.

Aurangabadi paper was glossy and thick. It had a few varieties like, Bahadur Khani (medium quality paper, thick, stout and durable), Sahib Khani paper (medium quality, thick), Murad Shahi paper (fine quality), Sharbati paper (thick and fine), Qasim Begi paper (thick), Ruba-Kari paper (This variety was made in to four or five different grades) and Balapuri paper (four or five varieties of different colures).

3.5.5 ECONOMIC ASPECTS OF PAPER INDUSTRY

There are, at present, about 400 units engaged in the manufacture of paper, paperboards and newsprint in India. The country is almost self-sufficient in manufacture of most varieties of paper and paperboards. Import, however, is confined only to certain specialty papers. To meet part of its raw material needs, the industry has to rely on the imported wood pulp and waste paper. Production of paper and paperboard during the year 2007-08 was 24.52 lakhs tonnes. At present, about 60.8 per cent of the total production is based on non-wood raw material and 39.2 per cent is based on wood.

Performance of the industry is constrained due to high cost of production caused by inadequate availability, high cost of raw materials, power cost and concentration of mills in one particular area. Several policy measures are initiated in recent years to remove the bottlenecks of availability of raw materials and infrastructure development. The capacity
utilization of the industry is low at 60 percentage. About 125 paper mills, particularly small mills, are sick and are lying closed. Several policy measures have been initiated in recent years.

The import of paper and paper products has been growing over the years. However, it increased during 2009-10 after a fall in 2008-09. About 70,000 tons of paper was exported in 2009-10 mainly to the neighbour countries. India’s per capita consumption of paper is around 6.00 kg, which is one of the lowest in the world. With an expected increase in literacy rate and growth of the economy, an increase in the per capita consumption of paper is expected.

3.6 PAPER INDUSTRY IN TAMIL NADU

Tamil Nadu is one of the well developed states in terms of industrial development. It has enjoyed a significant position in India’s geopolitical space and economic progress. Logistical advantages due to presence of three major seaports, an international airport and several domestic airports, quality of human resources, a peaceful industrial climate and a positive work culture have strengthened Tamil Nadu’s standing in the industrial world. The State’s business-friendly policies and proactive initiatives have played a key role in this resurgence.

Tamil Nadu continues to be one of the forerunners in the production of paper and paper products. There are 28 paper mills in operation in Tamil Nadu. The total paper production was 3.7 lakh tons in 2005 - 06, which accounts for 17.30 per cent share of the national production, next only to Andhra Pradesh. As the country’s forest cover is much below the desired
level, the Government of Tamil Nadu established Tamilnadu news print limited in 1979 to manufacture newsprint and paper using bagasse (sugarcane waste) as the primary raw material. This is the largest paper mill in India with an installed capacity of 2,30,000 TPA (tons per annum). In 2005-2006, the company produced 230079 MTs of newsprint and printing and writing paper.

TABLE NO.3.5
TOTAL PAPER PRODUCTION IN TAMIL NADU

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Paper Production in Tamil Nadu (lakh tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005 - 2006</td>
<td>3.7</td>
</tr>
<tr>
<td>2006 - 2007</td>
<td>4.0</td>
</tr>
<tr>
<td>2007 - 2008</td>
<td>4.4</td>
</tr>
<tr>
<td>2008 - 2009</td>
<td>4.8</td>
</tr>
<tr>
<td>2009 - 2010</td>
<td>5.3</td>
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</tbody>
</table>

Source: Indian Pulp & Paper Technical Association Industrial Directory - 2010

Tamil Nadu is engaged in the manufacturing of writing and printing paper (WPP) and news print. It is the 2\textsuperscript{nd} largest producer of WPP in southern India and has the largest paper plant of the country in terms of capacity.

Tamil Nadu is the largest producer of bagasse-based paper in the world especially at ‘Tamilnadu news print limited’.

Some more factors which would add up to benefit the paper sector are: The targeted rise in Exports which anticipates them to go up to 0.7 per
cent of global trade, Increased agriculture export which would also benefit the sector in terms of increased demand for packaging material, similar would be the effect of a booming Indian Retail Market & Robust FMCG players.

3.6.1 MAJOR PLAYERS IN TAMILNADU

The following are the of the paper units are major player in Tamilnadu

A) Tamil Nadu Newsprint and Papers Ltd.
B) Seshasayee Paper and Boards Ltd.,
C) Sun Paper Mill Ltd.
D) Subburaj Papers Ltd.

The particulars of operational efficiency and other details of such units are given in Annexure part of this report.

3.6.2 ROLE OF PAPER INDUSTRY IN ECONOMIC DEVELOPMENT

Paper industry is the second largest sector providing employment to 0.3 million directly and about 1 million people indirectly. Industry turnover is 120 billion rupees and contributes about 2.3 percentage of overall Indian industry’s output. Generally, the composition of Indian paper industry is wood-based (35-40 percent) and non-wood based (60-65 percent). The wood based industries are functioning under imported/indigenous hardwood/softwood, bamboo and the non wood based industries are classified as agro-residue based (functions under baggase and sabai grass, Jute/rag, wheat straw) and waste paper based (imported/indigenous waste paper,
corrugated/kraft waste paper, waste cuttings). The end products of paper industry are classified under

(i) Cultural paper accounts for 44 percentage of total domestic demand. It consists of writing and printing paper, office stationery, communication paper and specialty paper such as cheques and currency papers. The demand is a function of the GDP, the population, the literacy levels, and the standard of living.

(ii) Industrial paper accounts for 43 percentage the total demand in India. It consists of kraft paper, pulp board and duplex board, and is used in packaging applications. Demand depends on growth in industrial production, consumer durables, processed food, and other kind of packaging. This segment is relatively price inelastic.

(iii) Newsprint accounts for 80 percentage of the output. It depends on the number of newspapers, the size of the paper and the circulation. It has been placed under the OGL which means that newspaper companies are free to import any quantity of newsprint.

Large size mills (above 50,000 tpa) are reasonably modern and efficient but design capacities of world paper machines are about 20-30 times the capacity of the best Indian paper machines. Smaller size machines result in higher energy consumption besides quality constraints. Quality benchmarking with international standards improved technology are being used for cleaner, brighter and stronger paper. High speed machines of more than 1000 mpm are not many in India.
Paper industry represents an important segment of the Indian economy. The Industry has witnessed. A steady increase in installed capacity and production over the decades. The paper industry in India is primarily tree-free as 62 per cent of the market is catered by paper products from non-conventional raw material like agro-waste, agro-resides and recycled papers. The demand is estimated to be around 84.80 lakh tons in 2012-2014 on the basis of growth rate of 6.5 per cent for the period 2007-08 to 2012-2014.

At present, there are about 400 mills in the country with an annual installed capacity of about 51 lakh tons. They account for more than 5 per cent of the total installed capacity and production. At present, the capacity utilization in the paper industry is about 67 percent, as 125 paper mills particularly small mills are sick and are lying closed. Several fiscal incentives have also been provided to the paper industry, particularly to those mills which are based on non-conventional raw material. Import was 2.20 lakhs tons in 2009-10 and 3.05 lakhs tons in 2010-11. It is estimated to be almost 4.20 lakh tons in 2011-12. About 70,000 tons of paper is exported per annum mainly to the neighbouring countries.

India is the 10th largest industrialized sector in the world and it accounts for Asia’s 4th largest economy. The GDP growth rate is around 7 percent, one of the highest in the world and the GNP per capita is Rs.21,9576 or GNP 22,834 billion rupees. The economy size contributed to US $ 600 billion, growing @ 6 percent for the last five years. The value of exports (2007-08) is Rs.28,3605 crore and the values of Imports (2007-08) is Rs 34,6475.
3.6.3 NEWSPAPER DEVELOPMENT COMMISSION:

Newspaper Development Commission was started in 1st September 1982. The commission proposed the establishment of a Newspaper Development Commission (NDC) funded by a newsprint cess (i.e., specific tax) and an advertisement tax to help the growth of Indian-language, local and other small and medium newspapers. As well as owning large swathes of Pondicherry, the ashram also employs half its citizens in cottage industries producing goods ranging from perfumes to paper; it even runs a number of guesthouses including the Seaside Guest house.

The State, once a pioneer in the industry, has been virtually wiped out from the country's paper production map. Andhra Pradesh, Tamil Nadu, Gujarat, Punjab, Uttar Pradesh, and Orissa were playing an important role for the continuous growth and development of the domestic paper industry. The Calcutta Paper Traders Association (2008) CPTA has urged the West Bengal Government to take a fresh initiative to revive the State's paper industry. Tamil Nadu, Punjab, Uttar Pradesh, and Orissa were playing an important role for the continuous growth and development of the domestic paper industry.

Industries and Finance Secretaries (2004) considered it wiser to spend the money meant for Tamil Nadu News Print Ltd TNPL on ten mini paper mills to which they have not polluted the rivers. The paper industry is one example, before 2003, there was no excise duty on the first clearance of paper up to 2500 tonnes. Thereafter, the rate of duty was 16 per cent. The sales tax levied on paper was about 10 per cent in Tamil Nadu.
In order to improve the strength of the paper, spray starches were developed. Modified starches were also used in food industries as a thickener. It acted as a binding agent to improve consistency and shelf life of the product. In 22 colleges in Karnataka, Tamil Nadu, Andhra Pradesh and Kerala the smart card has been introduced and the benefits of the system are many. The lecturers and students have become tech-savvy. There is saving in terms of usage of paper.

State Industries Department has recently carried out an exercise to assess the requirements of technically trained manpower in sectors like mainly Paper, Engineering & Auto, Textiles and Chemicals. A company has launched a Rs 66-crore project for life cycle extension of the first paper machine. This was completed by March. Mr.Farooqui, who is the Tamil Nadu Secretary for Industries, said that the company has also embarked on a backward integration.

Selection is based on Tamil Nadu Common Admissions (TANCA) Test. During this period, newsprint, writing & printing, container board, carton board and others registered growth of 13 per cent, 5 per cent, 11 per cent, 9 per cent and 1 per cent respectively. The Indian Paper Industry accounts for about 1.6 per cent of the world's production of paper and paperboard.

With complete Implementation of the Mill Development plan in all respects, the company has moved from conventional bleaching to Elemental Chlorine Free process. The Paper industry is expected to grow to 10 million tonnes by 2010 and to 15 million tonnes by 2015.
3.7 CONCLUSION

The paper industry has been providing noble mobility services to the public more than hundred years. It has a vast fleet strength catering the paper needs of our state with the aim of extending economical and efficient service facility. Though it adhered to strict rules and procedures formulated by the state government, in resolving the grievances of employees and in understanding their attitude. Streamlining the Human Resource practices would be very essential to implement the best practices and enable the detailed study of the occupational stress of the employees.