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A Study of Green Supply Chain Management in Pulp & Paper Industries

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***Abstract*—*With the increasing competition to do good business, companies have already created many environmental issues. The stress on the environment is increasing as the level of energy and material intake is also increasing with increasing pollution from various sources, resulting in inadequacy of resources and dilapidation of the environment.*
The purpose of this thesis is to create an agenda that can be used by supply chains, particularly in the supply chains from the pulp and paper industry, to develop inner strengths and faintness and external openings and threats to develop environmental policies to recognize. To identify what questions to use in the framework of the environmental approach, we first identified the environmental picture, which the pulp and paper industry is facing. We then used this and the principle of green supply chain management to explore how a non-integrated supply chain firm could become greener, and compared it to an integrated green supply chain firm. Our conclusions suggest that the industry is focusing on reducing greenhouse gas emissions, but there is still much effort that needs to be done. Hence as a case study the supply chain management of THERMAL PAPER MANUFACTURER ASSOSIATION INDIA is reviewed.
Finally, we therefore present an environmental deliberate framework to explain what strategic options are in this particular supply chain that can make them greener. The general environmental outline presented can be used as a strategic tool to identify environmental strategic options for the supply chain.

Keywords*—*agenda, dilapidation, faintness, inadequacy, non-integrated,

I. INTRODUCTION

In 2018 the world's greenhouse gas emissions was the highest ever in history. The implications this will have is still unknown, but research done leaves no doubt that the climate changes we are facing today is a consequence of the increased amounts of gases that circulates in our atmosphere due to increased human activity following the industrialization. If the amount of emissions continues to increase, the middle-temperature of the earth will be higher than what is sustainable. Researchers are saying that if the global middle-temperature rises with more than 2 degrees Celsius until 2100 there is a large potential for "dangerous climate change ".

Clearly there is a need for action to be made. First in 1972 the environment and sustainability became a topic on the international policy arena, as the United Nations Environmental Programme (UNEP) was established. Since then it has inspired and encouraged governments and private organizations to become more environmentally conscious. Several initiatives have been started, environmental organizations established and new technology invented in the continuous work to improve the world's environment.

The pulp and paper industry are of particular interest when it comes to tackling climate change, as its main raw material is a natural resource that have proven to be a vital piece in the world's climate puzzle. Just small shares of extra gas in the atmosphere disrupt the natural balance. The forest industry is a large, energy consuming industry, and depending on trees as a raw material. The production process itself, due to intensive energy consumption, leads to 10 high levels of greenhouse gas emissions. In addition, deforestation releases large amounts of carbon dioxide in the atmosphere. Thus, this paper will address the question of how this non-integrated supply chain system is becoming greener, compared with an integrated supply chain and best practices in the industry. Our intention is to provide a general framework for a supply chain system that can be used to find which strengths and weaknesses they have internally and which opportunities and threats it faces externally in terms of the environment.

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II. PROBLEM DEFINITION

Green supply-chain management (GSCM) is gaining increasing interest among researchers and practitioners of operations and provide chain management. The growing importance of GSCM is driven mainly by the escalating deterioration of the environment, e.g. diminishing staple resources, overflowing waste sites and increasing levels of pollution. However, it's not almost being environment friendly; it's about good business sense and better profits. In fact, it's a business value driver and not a price center.

Greening the availability chain has numerous benefits to a corporation, starting from cost reduction, to integrating suppliers during a participative decision-making process that promotes environmental innovation. A growing number of corporations are developing company-wide environmental programs and green products sourced from markets round the world.

Many progressive companies, like ITC LIMITED(PSPD) have capitalized on the opportunities of green supply chain management and are therefore very concerned with the environmental burden of their supply chain processes. Throughout the availability chain, customers and thus firms designing and operating supply chains are particularly sensitive to reducing their carbon emissions. Operationally, this might involve carbon control of assets and infrastructure, the utilization of energy-efficient vehicles, waste reduction through process optimization, and recycling. Hospitality industry in India may be a global business and thus there's need for players within the industry to profile the service offering to evolve to global green supply chain best practices so as to stay competitive within the market. It's important for the hospitality industry players to conserve their key raw materials which is energy and water to enable them to understand sustainability within the availability chains. This is further curtailed by the ever-increasing costs of energy and inputs have forced business to seek out new ways to scale back energy use so as to scale back costs.

Research Objectives:

The general objective of the study was to spotlight the green supply chain best practices within the hospitality industry in India.
Specific Objectives:

To guide this study, the following four specific objectives were used:

1) To describe how green procurement is implemented as a green supply chain best practice in the Indian industry.

2) To describe how green design is implemented as a green supply chain best practice in Indian industry.

3) To describe how green operations and reverse logistics is implemented as a green supply chain best practice in Indian industry.

4) To describe how green manufacturing is implemented as a green supply chain best practice in the Indian industry.

5) To describe how waste management is implemented as a green supply chain best practice in the hospitality industry in India.

III. MATERIAL AND METHOD

Paper is made through the following processes:

Raw Materials Making: The wood obtained in the pulp mill comes in various forms. It depends on the pulling process and the source of the raw material. The bark is attached in the form of round-wood bolts and can be obtained in the form of chips, about half a dollar in size, from round wood produced from area.
If round timber is used, it is first dabbled, and wash water is usually applied by tumbling into large steel drums. If the pulping process calls for chemical digestion, paste those wooden bolts into the chipper. The chips are shaped, cleaned, and stored temporarily for further processing.

Fiber separation: During the fiber partition phase, many pulling techniques are deviated. The chips are placed in a large pressure cooker (digester), which contains a chemical suitable for craft chemical pulping.

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The chips are then digested by steam at different temperatures to separate the fibers and partially dissolve the lignin and other essences. Some digesters work continuously with a continuous feed of chips and the alcohol is intermittently charged and treated one batch at a time.

After the digestion process, the ripe pulp is released into a pressure vessel. Here the vapors and volatiles are closed. After that, this ripe pulp returns to the chemical recovery cycle. Fiber separation is less dramatic in mechanical pulp.
The process of masonry-floor timber forces the removed logs against rolling the stone wheels. Refiners are made by pulp and thermo-mechanical pulp chips. These chips are grounded by turning rapidly in two processes.

In the second step after cleaning, the pulp is scrubbed, rinsed, and most processed water is removed in preparation for making the paper.

Bleaching process:

The lignin and other discoloration in raw mash is so high that it needs to be bleached to produce a light-colored or white paper that is preferred for most products. The fibers are further transported by dissolving excess lignin from the cellulose through chlorination and oxidation. These include chlorine dioxide, chlorine gas, sodium hypochlorite, hydrogen dioxide and oxygen.

Strong alkaline sodium hydroxide is used to remove dissolved lignin from the surface of the fibers. Bleaching agents and the order in which they are used depend on a number of factors, including the relative cost of the bleaching chemicals, the type and condition of the pulp.

Mechanical pulp bleaching is different from chemical pulp bleaching. Bleaching of mechanical pulp is designed to remove lignin, which reduces fiber yield.

Chemicals used for chemical bleaching choose paint impurities, but include sodium bisulfite, sodium or zinc hydrosulfite (not used in the United States), calcium or sodium hypochlorite, hydrogen or sodium peroxide, and sulfur dioxide-boroalkine lignin and cellulin. Process (variation of the SO dime hydrosulfite method).

Paper Manufacturing Process:
Bleaching or uncooked pulp can be further refined to cut the fibers and the surface of the fibers will be thickened to increase the formation and bonding of the fibers as the fibers enter the paper machine.

Water is usually added to the pulp solution to form a thin mixture with less than 1% fiber. The dilute solution is cleaned in a storm cleaner and placed on the centrifugal screen before being fed into the 'wet end' of the papermaking machine. The thin stack passes through the head-box, which is uniformly distributed over the width of the sheet of paper forming the fiber solution.

IV. CASE STUDY

By studying this non-integrated supply chain, we have noticed that Thermal Paper Manufacturing Association is trying to make India greener, but using different methods. One common point is that they set certain environmental goals that they want to achieve, but they use different measures to reach them and are part of different activities with a different focus.

Green Design: Thinking green when designing can make a big difference to a company's product and environmental profile. Green design also does not appear to be a major focus for industry participants. They use “e-wheels” to understand and assess the environmental impact of their products. This cycle is divided into five stages: raw materials, manufacturing, distribution, use and end of life.

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Green packaging: It is not easy to estimate how much packaging is required for paper, but it is reasonable to assume that they are covered with something before shipping. Packaging is a big part of the operational life cycle, and because of this there are many ways to change the packaging process that makes up the supply chain. A greenhouse solution can be developed by using environmentally friendly materials for packaging.

Green procurement: Green collection consists mainly of forest management and production facilities. To verify a product, the entire supply chain from the jungle to the mills and the final product must be verified. Forest managers have systems for Sustainable Forest Management (SFM), and forest product traders rely on chain verification to find out the origin of the products.

Green Production: Thermal manufacturers are constantly working with improvements in their production process, which is environmentally friendly. He introduced his own e-index to more easily follow the company's environmental reforms. They set annual targets for 48 different parameters of the e-index and calculate the total e-index score for the entire company. His e-index score in 2016 was 1.14, which is below his 2015 target of 1.09. An index value of 1.0 or less indicates that the mill has an environmental standard that satisfies the performance achieved by the best technology or best practice available to the mill.

Energy: Paper production is a very energy efficient process, and most of the greenhouse gas emissions come from the energy they buy and produce to operate their mills. They use energy for two purposes: implementing production processes that separate fiber and water, and provide process heat and dry paper. They are trying to reduce various methods of energy reduction such as solar and wind to meet environmental standards.

Water: Water is used to grow fibers through the system in the process of pulp and paper production. 92 percent of the water comes from thermal producer surface water, and is used to cool machinery and equipment. Eighty percent of the water comes from groundwater, and only a small part comes from municipal water, which enters the production process through purchased raw materials as water is present in fiber-based raw materials. Thermal manufacturers have stated in their annual reports that the water they use is not overused, and that the water cycle is reused after treatment and treatment, permitting the use of water according to local regulations. When released, water undergoes therapeutic processes that remove solid particles and dissolve organic matter before it returns to nature. Water is usually used several times before treatment and returns to the water cycle.

Waste: Reducing the waste to landfill has been the main challenge for the industry, as the production process generates large amounts of waste. New innovations of technology have made it possible to make use of the waste though, and the paper producers are therefore continuously trying to reuse or recycle most of their waste. Especially the usage of waste for biofuel is something other paper producers are doing. However, Thermal manufactures does not seem to be successful when trying to reduce waste to landfill as the numbers has increased over the last few years. It is especially the production process with recycled paper that creates a lot of waste, because of the deinking process. It seems therefore somewhat strange that they sold their Chinese mill that used only recycled paper, and still the amount of waste to landfill is increasing. Unlike for water, the waste handling is not the same in different regions of the world.

V. CONCLUSION

We have examined various aspects of green supply chain management to improve environmental sustainability in the pulp and paper industry. After studying the non-integrated and integrated supply chain in this particular industry, we have developed a general framework that can be used as a strategic tool for identifying environmental strategies for supply chains in the pulp and paper industry. This framework is well suited to the pulp and paper industry, but it can also be applied to other industries with some adjustments.

Green Supply Chain Management is a new field and we thought it would be difficult to find good theoretical literature that addresses this issue. The literature we find focuses on very general or concrete topics, which companies have told or told stories about. We therefore provide a working environment framework for our entire supply chain system, looking at case studies from a specific non-comprehensive chain. Our research is challenging and somewhat confusing. Our research is challenging and

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somewhat confusing. An interesting finding is that many companies are very good at demonstrating the green actions they are taking, but neglect to mention what they cannot. In addition, there are many international programs, organizations and reporting systems, each with their own way of measuring and recommending goals.

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