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TECHNOLOGY
TO ANALYZE THE CONCEPT OF GREEN SUPPLY CHAIN MANAGEMENT IN
PAPER INDUSTRY**

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ABSTRACT

Paper industry is primarily dependent upon forestbased raw materials. 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. This paper explores the outcome in terms of operational performance, of green project partnership in the supply chain management system. Green project partnership, defined here as the degree of interaction between organizations in the supply chain regarding pollution prevention, can take place upstream with the suppliers and downstream with the customers. Using the data from a survey of the paper industry, the linkage between green project partnership and operational performances was analyzed. The results indicate that green project partnership with customers was positively linked to quality, flexibility and environmental performance while partnership with suppliers was associated with better delivery performance.

KEYWORDS Paper Industry, Supply Chain Management, Green Supply Chain Management, Stock Preparation, Sludge.

I. INTRODUCTION

The paper industries in India play a vital role in the Indian economy. The growth of the industries is rapid but the growth can't be stated as vigorous growth because of their awareness and concern towards environmental manufacturing. The industries are experiencing an increased pressure to reduce cost, improve quality and reduced time of delivery to sustain in the present market, so they are narrowed on focusing to the factors of their sustainability and other influencing factors to the environment are ignored. This research aims to survey the impact of environment-related interactions in the supply chain of operational performance in paper industry.

II. PAPER INDUSTRY IN INDIA

Manufacturing process

The process to be adopted for manufacturing paper from waste paper is the conventional method of mechanical pulping. This process is a well established one. The major stages involved in the process are pulping, stock preparation and paper making. It is a continuous process.

Pulping

Waste paper is sorted manually to remove impurities and then transported to the hydro pulpier. With the addition of water in the hydra pulpier the waste paper is slashed to form pulp. The pulp from the hydro pulpier at 4% consistency is screened through a Johnson screen at a consistency level of 1%. Further impurities like stapler pins, etc. Are removed in the sand trap. To remove light plastic articles the pulp is sent through turbo separator after which the pulp is thickened to 4% consistency level and fed through refiners to obtain the requisite degree of fineness. The waste paper pulp is taken to the next section.

Stock Preparation

In this section, the pulp is treated with chemicals, necessary filling materials and dyes are added to it. The various chemicals and dyes added to the pulp are normally alum, rosin, caustic soda, silicate, acid orange, methyl violet, malaise green, and direct black etc. To obtain various grades of paper. The requirement of various chemicals and the quality varies with variety of paper to be produced. The treated pulp which is ready for paper making is kept in the stock chest with continuous stirring up with the help of agitators. The pulp stock is then sent to head box of paper machine after cleaning it through centri-cleaners to remove heavy particles, additives etc.

Paper making

Paper making process consists of two stages:

- 1) wet stage
- 2) dry stage

Machineries in the wet stage are generally called wet part and similarly dry stage machineries called as dry part. In the wet part an endless wire mesh running on rolls will continuously drain water from the pulp. Pulp enters the paper machine head box at a consistency of 0.5% to 1%. Application of vacuum in the hydrofoils positioned under the wire enables removal of water. The pulp now forms into a wet mat. This is now lifted off and sent through a press for further removal of water. The web is now dried over steam heated mg cylinder where the dry part starts. The paper obtained after drying is the final product with monoglazing. The final moisture content in paper is about 3 to 5%. Final product is slit and rewound paper core into reels and labeled. Various grades of paper with different grammage are manufactured by adjusting the valve and sluices at the head box. The plant can be run continuously for a given variety of paper without interruption. However, to change over from one variety to other, the paper making operation has to be interrupted depending on the changes required to be made either in pulping stage or in stock preparation.

III. OBJECTIVES

1. To determine the practices being followed in paper industry using green supply chain management.
2. To overcome the problems arising in paper industry using green supply chain management.

IV. MATERIALS AND METHODS

In a research work there are two methodologies qualitative and quantitative research. The research method used in this thesis would be both qualitative method and quantitative method because the qualitative method will be helpful for investing questions like how and why of research and quantitative method will be calculating approximate figures with some assumptions. The qualitative method served the purpose well since the objective of the thesis was to find what will be the best method and tools for eliminating paper industry wastes and what they considered as main obstacles on implementing the concept and also how to develop paper industry in India according to GSCM concept.

Research Questions

Q1. In which extent is the paper industries in India are aware of implementing green supply chain according to their present market demands?

Here it is asked to know how much the concept of green supply chain management is understood and practiced by the paper industry today. It is also analyzed whether their present market demands and expectations of customers help or deny them in practicing Green supply chain management.

Q2. What are the wastes parameters considered in the life cycle process of the final product and how are the final wastes and scraps are disposed?

This part explains how the life cycle process of the final product is followed by the paper industry and it also points out the waste parameters considered by the industry. The methods regarding waste disposal are also discussed. This will provide the reason and evidence on the waste management practiced by the industry. The methods to overcome and implementing green supply chain management can be easily sorted out accordingly.

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Q3. Which improvements potential are there in paper industries in India with respect to and with help of green supply chain management?

With green supply chain management in paper industry, one should first investigate what extent this will be helpful in following green supply chain management and how much it will help to increase the environmental and economical gains of the industry. Here it will be analyzed to see what potential the Indian paper industries have to improve and gain from green supply chain management.

Q4. What are the practices that can be learnt from the theories and actual implementation of green supply chain management in Indian paper industries?

The existing theories give an importance and reason for implementing green supply chain management and it also describes about successful implementation in paper industries in India. It will be analyzed to sort out the best practices of green supply chain management by experiencing, learning the different theories and approaches towards implementation of green supply chain management by the industry regardless of their economic difference.

Q5. What are the advantages and disadvantages for Indian paper industries to implement green supply chain management?

The survey to find out the factors that influence in implementing green supply chain management has been analyzed properly and what the industries really concern as their difficulties in implementing it is provided with relevant information. This will provide the answer to the industry to see which they consider as the main obstacle for implementing green supply chain management.

V. RESULTS AND DISCUSSIONS

Cost of Production

Years	1	2	3
Installed Capacity (MT)	6000	6000	6000
Utilization	60%	70%	80%
Production/Sales (MT)	3600	4200	4800
Selling Price	Rs.23,000per MT		
Sales Value (Rs. In lakhs)	828	966	1104
Raw Materials (Rs. In lakhs)	342	399	456
Consumables (Rs. in lakhs)	118.8	138.6	158.4
Power (Rs. In lakhs)	77.35	90.24	103.13
Fuel (Rs. In lakhs)	72	84	96
Wages & Salaries (Rs. In lakhs)	53.28	55.94	58.74
Repairs & Maintenance (Rs. In lakhs)	6	6.6	7.26
Depreciation (Rs. In lakhs)	74.39	56.1	42.35
Cost of Production (Rs. In lakhs)	743.82	830.48	921.88
Admin. & General expenses (Rs. In lakhs)	24	25.2	26.46
Selling expenses (Rs. In lakhs)	24.84	28.98	33.12
Interest on Term Loan (Rs. In lakhs)	27.24	23.84	17.03
Interest on Working Capital (Rs. In lakhs)	15.37	15.37	15.37

Profitability Ratios Based On 80% Utilisation

- 1) Profit after Tax / Sales = $(59.60 / 1104.00) * 100 = 5\%$
- 2) Profit before Interest and Tax / Total Investment = $(122.54 / 530.99) * 100 = 23\%$
- 3) Profit after Tax / PromotersCapital = $(59.60 / 175.90) * 100 = 34\%$

Land & Building

Land with an area of 3 acres is sufficient. The constructed area of the building is 16000 sq. ft.

Utilities

Electricity: Power requirement is 480 KW.

Steam & Fuel: Fuel is required for steam generation. The steam requirement is about 2.3 tons for one ton of paper production.

Water: Water is required for pulp washing, steam raising and general cleaning. 200 Kilolitres of ground water is required per day for cleaning.

Manpower

	Num ber	Monthly (Rs.)	Total monthly(Rs.)
Works Manager	1	10000	10000
Supervisors	3	6000	18000
Electrical engineer	1	6000	6000
Mechanical eng.	1	6000	6000
Finishing/warehouse/st ore.	3	4000	12000
Skilled	30	4000	120000
Semi skilled	21	3000	63000
Unskilled	24	2500	60000
Security	6	2500	15000
Managing Director	1	12000	12000
Finance Manager	1	10000	10000
Marketing Manager	1	9000	9000
Sales Representative	2	6000	12000
Accountant	1	5000	5000
Assistant	3	4000	12000
			370000
Add : Benefits		20%	74000
Total			444000

Waste generated from Paper Industry and measures taken respectively

- 1) Rejects: The rejects are basically the impurities which consists of lumps of fibers, staples and metals from ring binders, fillers involves sand, glass and paper constituents, sizing agents and other chemicals.

Measure taken: If the thickened residues are incinerated in an environmentally compatible incineration plant, e.g., fluidized bed, the steam for the mill operation could be met, fully or partially.

- 2) Deinking sludge: Deinking sludge is mainly a residue which contains short fibers or fines, coatings, fillers, ink particles (a potential source of heavy metals), extractive substances and deinking additives.

Measure taken: Ink particles are a potential source for Zinc and Copper, but along with secondary bio-sludge, combined sludge is compatible for incineration. Deinking sludge is normally dumped or incinerated. The ash can serve as a resource for building materials.

- 3) Primary sludge: This sludge is generated in the clarification of process water by kidney treatments, e.g. dissolved air flotation. The sludge consists of mostly fines and fillers depending on the recovered paper being processed and it is relatively easy to dewater.

Measure taken: In the board industry and for production of corrugated medium, it is often recycled to the process. Fibre recovery helps in minimizing the quantity of residues.

- 4) Secondary or biological sludge: Secondary sludge volumes are lower than those corresponding to the primary sludge, since most of the heavy, fibrous or inorganic solids are removed in the primary clarifier.

Measure taken: This sludge is generated in the clarifier of the biological units of the wastewater treatment, and it is recycled to the product (board industry) or thickened, dewatered and then incinerated or disposed of in landfill.

VI. CONCLUSIONS

We have made a description of the supply chain management and the planning tasks of the paper industry. Thereafter we made an overview of commercially available planning support off-the-shelf as well as the state-of-the-art of relevant research. We can conclude that support is available for most of the planning tasks. Based on this results we conclude that more research should be carried out on the implications of uncertainty to green supply chain management in paper industry before it is incorporated into practical systems. This is crucial in a production system where transition costs are high and cycle times therefore long. The concept of GSCM is not commonly known or implemented in paper industries in India. The effects of GSCM are considered to be raised costs rather than less. In order to motivate the companies with GSCM some general actions were suggested. The concept can only be fully implemented when the government involvement is more because the knowledge and education on the concept can be provided to these industries only by them. The rules and regulations must be made liable and some subsidiaries should be provided to the industries that implements GSCM.

VII. FURTHER SCOPE

According to the thesis there is need of brief study on the concept of green supply chain management, methods, tools and techniques for reducing green wastes identified in the industries, so the literature review would be the best way of describing the factors. The literature review written was mainly based on the respondents from the industries through interviews and the questionnaire answered. More research should be carried out on the implications of uncertainty to green supply chain management in paper industry before it is incorporated into practical systems. This is crucial in a production system where transition costs are high and cycle times therefore long.

VIII. REFERENCES

- [1] Zhu Q., Sarkis J (2004) "Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises." *Journal of operations management*.
- [2] Rao P. (2004) "Greening production: a south East Asian experience." *Journal of operations and production management*, 24:289-320.
- [3] Kumar, S., Chattopadhyaya, S., & Sharma, V. (2012) "Green supply chain management: A case study from Indian electrical and electronics industry". *International Journal of Soft Computing and Engineering*, 1(6), 275-281.
- [4] Luthra, S., Kumar, V., Kumar, S., & Haleem, A. (2011) "Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique: An Indian perspective". *Journal of Industrial Engineering and Management*, 4(2), 231-257.
- [5] Sarkis, J. (2003) "A Strategic Decision Framework for Green Supply Chain Management," *Journal of Cleaner Production*, vol.11, 2003, pp.397-409.
- [6] Walton, S; Zhu, Q (1996) "Green Supply chain" a study over this terminology in the European Journal..

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