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ENVIRONMENTAL ECONOMIC ANALYSIS OF WASTE PAPER RECYCLING WITH SPECIAL REFERENCE TO VALACHENNAI PAPER MILLS

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ABSTRACT

Paper is an important element of modern life however, its Utilization has negative externalities associated with its production as well as consumption. Production of paper, using wood pulp or paddy straw as a major component is referred to as conventional production. It causes environmental pollution. Solid waste generated in Sri Lanka consists of considerable portion of waste paper. In Sri Lanka, National Paper Company Limited (NPCL) carries out recycling of waste paper mainly at its Valachennai mills. Recycling of waste paper is environmentally and economically cost effective when compared to conventional production. There are avenues to enhance the present reuse ratio of waste paper, through usage of quality waste paper and better technology. Recovery of waste paper and lack of sale of locally produced paper and products are major barriers to recycling effort. Relaxation of import tariff on paper, adversely affected the paper recycling. Collection of waste paper could be enhanced by the introduction of better market – based incentives. Environmentally levy could be imposed on paper imports at least for industrial purposes as a signal for social cost. Accurately valuing the price of waste disposal and internalizing waste management cost will also make recycling more an attractive alternative.

INTRODUCTION

The world faces two vital problems namely resource limitation and pollution. To enable sustainable development pragmatic alternatives have to be evolved. Recycling has a very positive

impact on the environment and also conserves energy and resources for future use.

Paper has become an important element in life. Consumption of paper is considered to be an indication of level of civilization. Paper can be produced from virgin materials such as wood pulp or straw as a major component. It is said to be conventional production (Smook, 1982). Alternatively recycling of waste paper utilizes recycled fibre as a major fraction of final out put. Recycling of waste paper reduces the negative environmental impact (Titenberg, 1992).

Paper production in Sri Lanka has been initiated using wood pulp as a raw material. Dwindling forest resources made the use of wood environmentally and economically costly. Then straw has been used as an alternative raw material. Use of straw is associated with following disadvantages low paper quality, damage to machinery due to its' high silica content and pollution of water bodies due to the emission of toxic effluents. In Sri Lanka paper production is largely carried out by two paper mills belonging to the National Paper Company Limited (NPCL), located at Valachchenai and Empilipitya. According to the study carried out (CEA, 1992), the toxic effluents from the factory severely affected the fish population in the adjoining water bodies, when conventional production is carried out. According to the UNEP (1996) virgin pulp mills have polluted waterways with oxygen hungry effluent and toxic chemical, resulting in contamination of waterways.

Paper recycling has multifaceted beneficial effects in terms of overall resource use efficiency. Holmes (1984) revealed that, in the hierarchy of solid waste management recycling comes to second to waste avoidance.

Virgin material pulping has an environmental cost. The correct treatment of this environmental cost will increase the rate of recycling. One study by Spofofford (1971) examined the

significant of the costs in the paper industries as a function of reuse ratio.

Reuse ratio denotes the ratio of recycle raw material input to virgin raw material input in the final product. He found that external damage and treatment costs were much higher with lower reuse ratio. Oates (1992) has revealed that negative externalities created by the production of paper from virgin pulp are not considered in the process of pricing. Therefore environmental benefits of paper recycling should be reflected in the pricing of waste paper. Since the social benefits of recycling waste paper is more than market price of waste paper, this may be basis for proposing financial subsidies to waste paper recovery (Titenberg, 1992).

Valachchenai paper mill is the first Sri Lanka pulp and paper mill established in 1959. Present production capacity of mill is 22500 MT / annum. It consists of paper machine and board machine. It switched to waste paper recycling technology in 1989. In this backdrop this study focuses on the environmental economics aspects of paper recycling with special reference to Valachchenai Paper Mills.

OBJECTIVE OF THE STUDY

Overall objective of the study is to examine the economic and environmental efficiencies of waste paper recycling. Specifically looks into the cost effectiveness of recycling with the conventional production estimation of resource use levels in each production technology constraint analysis.

METHODOLOGY

Primary mill data for the study were collected from NPCL and Ministry of Forestry and Environment. In-depth interviews were also conducted with officials of above - mentioned institutions. Cost effectiveness analysis is carried out to assess the competitiveness. In environmental analysis consumption of

resources for unit weight of paper production under both technologies were estimated.

Production data for the Year of 1988 and 1998 are selected as proxies for both technologies conventional production and recycling respectively. In 1988, production was based primarily on pulping of rice straw while in 1998 production was based on recycled fibre. The analysis considered only a few popular grade of paper, as the product lines are not entirely identical in the proxy years. White writing is the major cultural grade in the present use and boxboard and boxboard and corrugated medium are the main industrial grades. In the calculation of average resource consumption the temporal differences in the composition of product lines are not considered.

RESULTS AND DISCUSSION

Cost Competitiveness

Since benefits are difficult to quantify and monetarily valued, cost effectiveness analysis is carried out. Analysis used technical and economic mill data to examine the relative differences in cost of production between conventional production and recycling for various grades of paper.

Table 1. Manufacturing Cost of Paper Grades

Cost of Components	Corrugated Medium		Box board		White writing	
	Conventional (Rs.)	Recycling (Rs.)	Conventional (Rs.)	Recycling (Rs.)	Conventional (Rs.)	Recycling (Rs.)
Furnish	5376	2406	6894	3860	13752	9644
Additives	559	576	782	1280	1166	1603
Services	3759	2576	3759	2424	3401	2531
Total Var Cost	9694	5558	11435	7564	18319	113778

Inflation adjusted prices

As shown in Table 1, by adopting recycling total variable cost of production of corrugated medium was brought down by 42%. This is a considerable cost saving. Total variable cost of production of boxboard was brought down by 33%. Manufacturing cost reduction for white writing is 24%. Fixed costs for both technologies are considered as similar. In accordance with the technicality the fixed cost of recycling technology is much lower than the fixed cost of conventional production. As many structural components like digesters used for cooking the virgin materials are no more necessary for recycling.

Reuse Ratio

Reuse ratio is less in cultural grades (Fig 1.). Only Grade I and Grade II waste papers are recycled in the production of White writing. It's recovery is much limited as it is often soiled with other low – grade papers and other debris. Reuse ratio in cultural grades could be enhanced by the use of improved technologies and source separation. Source separation means separating the waste into categories where it is generated. By the use of de linking technology, colored used papers could be converted for the use of production of white writing.

Reuse ratios in the production of corrugated medium and boxboard are satisfactory. A negative correlation between the reuse ratio and the cost reduction is clearly visible. But the market prices for industrial grades are lower than the cultural grades. Therefore increase the reuse ratio of cultural grades raises the value of waste paper.

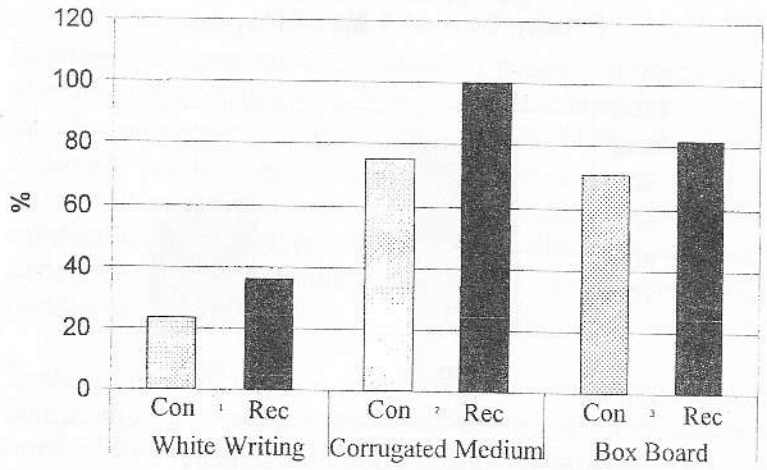

Figure 1. Reuse Ratios

Energy and Water Saving

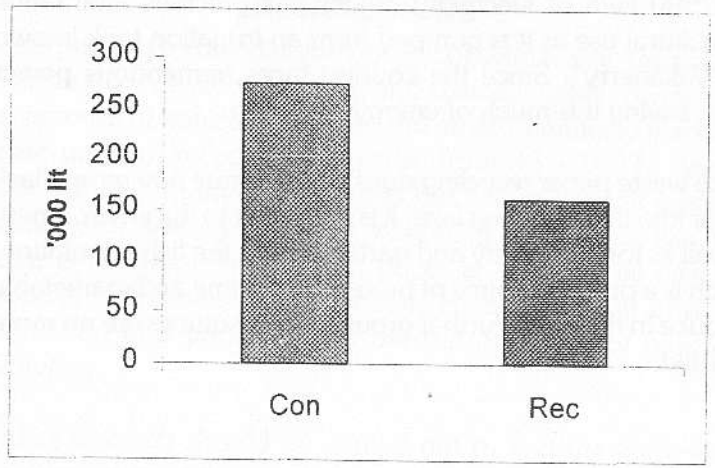

Figure 2. Consumption of Water

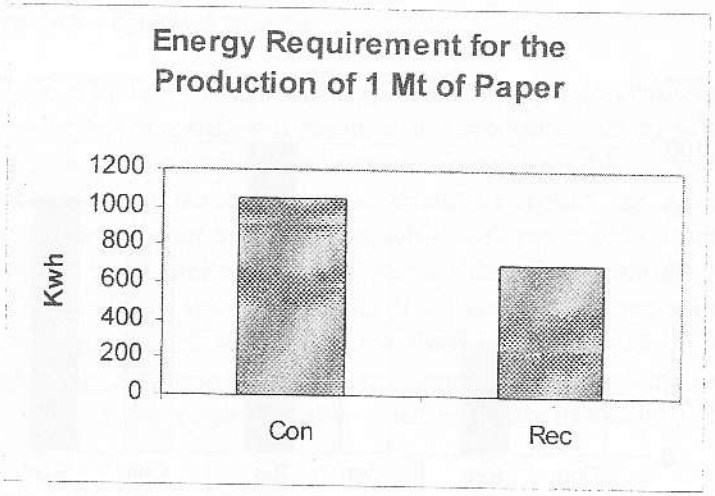

Figure 3. Consumption of Electricity

Energy and water are critical issues in natural resource management. To produce 1 Mt of paper, recycling techniques saves 1116000 lit of water and 331 kwh of electricity. In full capacity operation the mill saves 2610 Million liters of water 7447500 kwh of electricity. Water has precious alternative agricultural use as it is pumped from an irrigation tank known as "Vakanerry". Since the country faces tremendous power crisis, saving this much of energy is a boon.

Since waste paper recycling does not generate any more black liquor into the adjoining lake, it is a bequest to the environment as well as for the society and particularly to the fish population, which is a primary source of protein and prime and marketable produce in the area. Further ground water sources are no more polluted.

Constraints in Waste Paper Recovery, Recycling and Product Marketing

Economic management is critical to paper industry due to obsolete technology i.e. Age – old machineries are not maintained properly due to lack of funds. In the absence of sufficient waste, paper mill's operation is likely to cease functioning. As the procurement of waste paper is not satisfactory, the company would be compelled to import waste paper spending a considerable amount of valuable foreign exchange.

Trade liberalization also contributed to dwindling capacity utilization of the mill. Capacity utilization of the mill dropped from 79% in 1993 to 52% in 1998. As a result of trade liberalization tariffs on imported paper was slashed from 60% to 5% in stages. It also resulted in tremendous inflow of paper products, which are superior in quality and low in cost. It has drastically affected the marketing of local paper product.

CONCLUSIONS

Waste paper is a considerable portion of solid waste. Recycling of waste paper is economically and socially viable, consumes less amount of natural resources and environmentally friendly. Reuse ratios of recycled fiber varies from 36 – 100%. Reuse ratios are high in industrial grades but low in cultural grades. Recovery of waste paper and marketing of produce are the major constraints. Recovery of paper is hindered by lack of financial incentives for collection. Relatively high cost of production and paper quality are the problems of product marketing.

Further research should be carried out to find the important variables of recycling such as marginal social cost of both technologies, optimal reuse ratio and value of environmental and social benefits of recycling.

RECOMMENDATIONS

Environmental benefits of paper recycling should be reflected in the purchasing price of waste paper. This may justify the provision of financial incentives for promoting the waste recovery.

Unit based garbage disposal system associated with disposal fee could be introduced on a pilot basis in metropolitan areas, where the garbage collection mechanism already exists.

Research and development must be encouraged to lower the cost of production of paper, adding value to the recycled fiber, increase the fiber content in the output and exploit the growing market for cultural grades.

Market demand for recycled products could be enhanced via Eco Labeling.

Favourable trade policies are imperative to protect the market for locally produced recycled paper products until the paper production reach the competitive edge. Imposing moderate tariff is an important tool to indicate social cost.

Collection mechanism for paper waste must be strengthened at the local government level as they are at the grass root level.

Mobilization of social capital towards waste paper recycling, via formal and non – formal educational means is an imperative.

Considering the effect of paper recycling on employment, foreign exchange savings, environmental pollution abatement and natural resource conservation, proper weights should be assigned in development plans.

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