

CASE REPORT

Management of Paper, Furniture, Food Waste, Furniture Waste through Case Studies

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ABSTRACT

The current article at the outset deals with a case study on paper recycling via a study by Elora board. The whole process of paper recycling has been depicted in a flow chart. There are 2 figures and 3 tables that depict data related to the article.

The first part of this article concludes that the three mills mentioned produced different kinds of products. The Elora mill produced kraft papers, the Bazargaon mill produced paper boards and the Malu mill produced newspapers as well as paper boards. The waste paper from newsprints was used to produce paper boards.

The second aspect that the article deals with is to feed unused and uncooked vegetables leftovers to cattle so that they are converted to dung & thus manure.

The article refers to the publication by the Food & Agricultural Organization (FAO) in 2022. This report mentions that India turned out to be the largest producer of ginger, onions, and okra and ranked second in the production of potatoes, cauliflowers, brinjal, cabbages etc. India is also the top most producer of bananas, followed by mangoes, guavas and papayas. This shows the extent of the range of horticulture production at the national level.

The use of wastes as ruminants & non ruminants is an important issue in the article that is reflected through the data provided by the industry. There is another case study mentioned in the article and it was done by the Centre for Responsible Business (CRB) and Aston India Centre for Applied Research to explore how private companies are contributing in working for the Sustainable Development Goals (SDG).

KEYWORDS

• SDG • FAO • Ruminants • Paper • Furniture • Horticulture

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INTRODUCTION

At the forefront of this article is a significant case study depicting paper recycling. The case study is regarding a study conducted in the Elora Board Mill in Tumsar, Malu Paper Industry and the Bazargaon Paper Industry by Vipul S. Agarkar, P. Rahul Rao, Dnyanesh Sankulwar and Aamir Sayed.¹

According to the study, the Elora board mill produced news print and Kraft paper. A seven step was followed by the company for

the recycling of paper. First, the paper was re-pulped using a hydro-pulper. Then it was screened to remove any undesirable materials. The cleaning of the paper was then done using a turbo cleaner to remove small particles of dirt and grit. Taizen was then used to break blocks of water and pulp. This was done to get a powdered version of the pulp, Then the powdered pulp was stored in a tube and cooled if needed. The following figure shows the whole process.^{1,2}

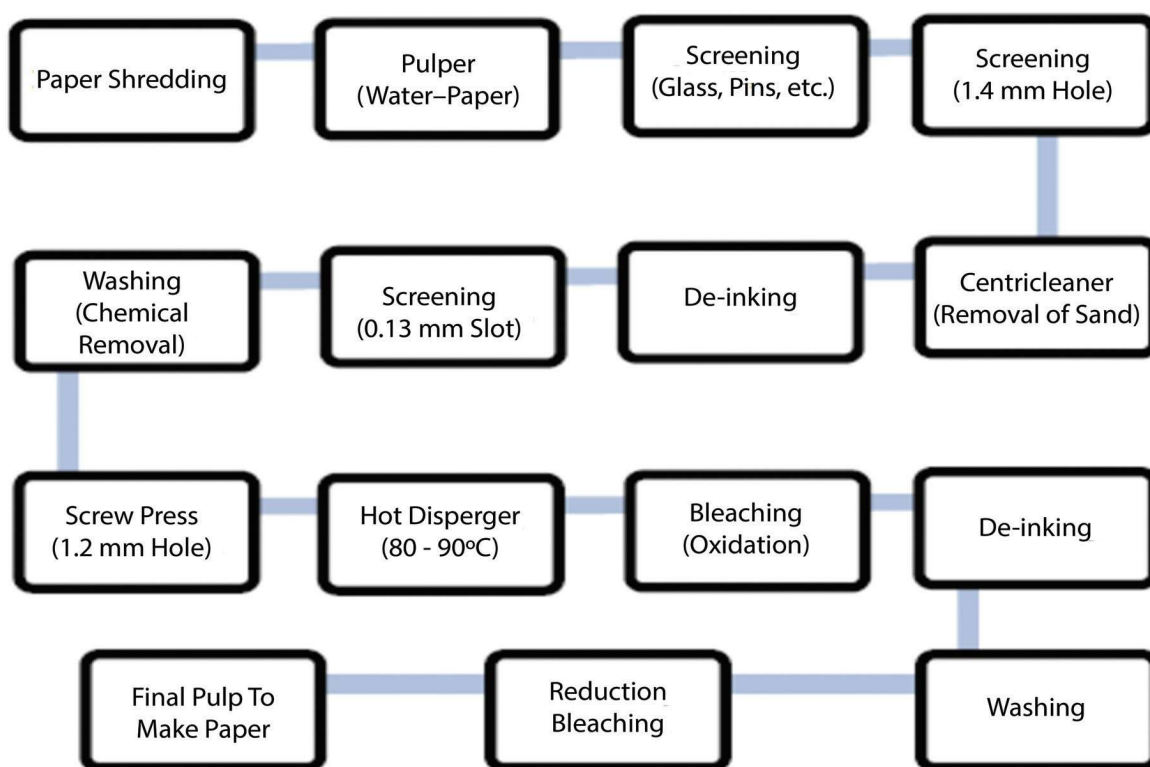


Figure 1: Paper recycling process of the industry

The powdered material was then sent for rolling on a conveyor belt to give the desired shape. After this, hot rollers were used to harden the pulp for making paper. Cutters were used at last to cut the paper in the desired format. The mill cut at least 410 kg of paper at a time.¹

The Malu paper industry had three paper manufacturing units in Nagpur. The company produced kraft paper and newspapers in the first plant. The MG Kraft paper was used for corrugated boxes meant for packaging. Several local and national newspapers got their papers printed in this plant. The second

plant manufactured newsprint using paper recycling technology of de-inking developed by Lamort, France. The third plant used the top tier technology from ANDRITZ Finland. The paper machine was from Beloit and the Calenders were from the Kusters. The plant operated on a Variable Drive Controlled system from ABB.^{1,2}

The Bazargaon industry was located at the outskirts of Nagpur and manufactured test liner corrugated medium kraft-liner. The waste papers were collected from the city and kept in a store room. They were then separated, checked and put in a hollow pulper. This task was done

manually by unskilled labourers. After this, the paper pulp was prepared by mixing with the hard waste material, water, starch and hydrogen peroxide. The mixture was then turned into a paste. The chambers with belts then purified the pulp from this paste. The third step was de-inking for decolourisation. Dyes were then added to get the desired colour. The pulp was then sent for making paper into the rollers and got converted into thin sheets. The suction vacuum sucked the extra water from the sheets and then they were dried used other rollers. The output value was measured in terms of GSM.^{1,2}

To conclude, the three mills produced different kinds of products. The Elora mill produced kraft papers, the Bazargaon mill produced paper boards and the malu mill produced newspapers as well as paper boards. The waste paper from newsprints was used to produce paper boards. The Elora mill produced papers of quality 40-70 GSM, the malu mill produced 35-70 GSM quality paper and the Bazargaon mill papers of quality 50-60 GSM.^{1,2}

The second aspect of this article is 'Feed unused and uncooked vegetables leftovers to cattle'.^{3,4,5}

According to the first advanced estimates of the Fiscal year 2023-24 released by the Department of Agriculture and Farmers' Welfare for the area of production and horticultural produce.^{3,4,5}

The area of production has been estimated to be, 28.77 million/Ha while the production was 355.25 million tonnes. The second advanced estimates show the production to be around 352.23 Million tonnes. The area of production has increased by 3.27 lakh Ha as compared to the final estimates of 2023-24.^{3,4,5}

India is the second largest producer of fruits and vegetables fruits and vegetables after China, in the world. As per the data released by the National Horticulture Board in National Horticulture Database during 2023-24, the Indian production of fruits and vegetables amounted to 112.62 million metric tonnes and 204.96 million metric tonnes respectively.^{3,4,5}

As per FAO (2022), India turned out to be the largest producer of ginger, onions, and okra and ranked second in the production of

potatoes, cauliflowers, brinjal, cabbages etc. India is also the topmost producer of bananas, followed by mangoes, guavas and papayas.⁷

The 2023-24 export estimates show that India exported fruit and vegetables worth Rs. 15039.27 crores. A large portion of the fruits exported comprised of grapes, pomegranates, mangoes, oranges and bananas. Onions, potatoes, tomatoes, mixed vegetables and green chillies were the major categories of the vegetable that were exported.^{3,4,5}

India mostly exports its horticultural produce to UAE, USA, Bangladesh, UK, China, Saudi Arabia, and Netherland.^{3,4,5}

The National Agricultural Market (e-NAM) is responsible for creating a unified national market for agricultural products and commodities. It creates a network of the existing mandis (whole sale market place). It was launched on 14th April, 2016. It is implemented by Small Farmers Agribusiness Consortium (SFAC) under the Ministry of Agriculture and Farmers' Welfare.⁶

e-NAM helps promote marketing opportunities for farmers through a transparent price discovery system in a competitive online environment and an online mode of payment.⁶

Currently, 1389 APMC mandis have been linked with e-NAM across 23 states and 4 UTs. The total numbers of APMCs as per the data of ministry of agriculture in 2018 are 6639.⁶

India generates about 55 million tonnes of Foodx and Vegetables Waste (FVW) through activities like processing, packaging, distribution and consumption. Most of this waste directly goes into landfills or rivers.⁷

FVW can act as an unconventional source of nutrients and act as feedstuff for animals. Currently, India faces a shortage of concentrates (25 million tonnes), green forages (159), and crop residues (117 million tonnes). An increasing population makes it difficult to increase the area of fodder production while the industrial approach of livestock production hikes the production cost. At the same time, the global prices of feed ingredients like maize, wheat, fish meal and soya bean meal have also increased by 160,118,186 and 108 percent. However, the price hike for livestock products wasn't significant.⁷

Table 1: Wastes & their use as ruminants & non ruminants

Waste	Ruminants	Non-ruminants
Dried apple pomace	✓	✓
Leaves, young stalks and pseudo stems of banana	✓	✓
Banana peels	✓	✓
Citrus fruits	✓	✓
Mango	✓	✓
Pineapple	✓	✓
Baby corn	✓	✓
Bottle gourd	✓	✓
Carrot	✓	✓
Potato	✓	✓
Sarson Saag	✓	
Snow peas	✓	
Sugar beet	✓	✓
Tomato	✓	✓

The above table shows various wastes and their use as ruminants. Dried apple pomace can be used to feed ruminants like lactating dairy cows or Holstein cows. It contains 7.7 percent crude protein and provided 1.86 Mcal of metabolising energy. For non-ruminants, dried apple pomace can be used to replace maize nearly by 10 percent. Dried apple pomace diets complemented by commercial enzyme preparations have helped improve the performance of broilers.⁷

For Banana, its leaves, young stalks, pseudo stems and peels are mostly used for feeding ruminants and non-ruminants. Pseudo stems are easier to digest and are provided after being dried to goats and sheep. Growing pigs and rabbits are fed with banana leaves. Banana peels are rich in trace elements like Fe, Cu and Zn. Banana peels are basically used by small and marginal farmers as complementary feeds for ruminants. Growing pigs and rabbits are also fed dried peels of banana. They help replace 75-100 percent of maize in rabbit diets. Broiler diets also contain banana peels.⁷

Lactating dairy cows are fed with dried citrus pulp. It produces a buffering effect on rumen pH. It is considered to be safe for animals fed on high concentrate and low roughage diets in like high-yielding dairy cows. It is capable of replacing concentrates in dairy cattle and lactating ewes. Non-ruminants like growing

pigs, pregnant sows and poultry are also dried citrus pulp. Ensiled citrus pulp and citrus molasses also act as feed stuff for ruminants and non-ruminants.⁷

Mangoes produce usable wastes like seed kernels and peels. Both can be fed to ruminants and non-ruminants. Seed kernels are fed to both sheep and broiler chicks. Dried mango peels are fed to finishing pigs along with ruminants. Pineapple wastes are included in the dirt cattle, sheep and goats. Animals generally prefer fermented pineapple waste. It can also be combined with rice straw in the mixed ratio of dairy cattle. Pigs do not prefer consuming pineapple waste. It proved to be beneficial mostly in the older pigs.⁷

Most of the vegetable waste like carrots, potatoes, sugar beet and tomatoes can be fed to both ruminants and non-ruminants. Baby corn, bottle gourd, snow peas and Sarson Saag are the vegetables that are only fed to ruminants.⁷

Vegetable waste is also used as a source of nutrients in urea molasses. Urea molasses are developed using waste bread and tomato paste to replace wheat flour and mustard cake.⁷

To conclude, there are several uses of FVW and it can help improve the quality of livestock.⁷

The next section is regarding a case study on food waste done by various stakeholders. This case study was done by the Centre for Responsible Business (CRB) and Aston India Centre for Applied Research to explore how private companies are contributing in working for the SDGs while being a part of the Global Value Chains. The study was supported by the International Development Research Centre, Canada.⁸

Waste link is a start up that offers a high quality solution for managing pre-consumer food waste and converting it into nutritious animal feed. It targets SDG 12(Responsible consumption and Production).⁸

The start up had processed 6000³ tons of food waste. Its target beneficiaries were the food producers and the buyers of animal feed. Almost all the entities in the value chain were covered in the process. It procured the waste from suppliers, manufacturers and distributors. Several animal nutritionists advised on production of appropriate food combinations. Food that was not fit for animals went for energy production or composting.

The start up also developed an app to track the waste and carry out stock audits.⁸

It had two major departments, R&D and the mechanical department that ensured proper working conditions in the labs. The start up helped divert loss from landfills and improve the value of production. The app also helped track the quantifiable emissions to map the contribution to SDG 12.⁸

The whole process helped avoid emissions from landfills to environmentally manage the chemicals and prevention of virgin production of fee.⁸

The forthcoming section is a behavioural aspect that saves paper. The behaviour is to 'set printer default to double side printing'. According to the university of IOWA, Double sided printing is an excellent method of cutting down on the waste generated in labs. Most of the documents that require more than one page can be printed in a double side format. This practice can significantly reduce paper waste and energy consumption.⁹

Moving ahead, the next aspect of the article is behaviour at household & community level. The act is to 'repair, reuse and recycle old furniture'. According to CSIL, India is the fourth largest producer of furniture in the world with a market value of US\$ 19 billion in 2023. A 34% urban portion of Indian population generates a gigantic amount of waste every year. Nearly, 4 - 5% of the household waste in landfills is furniture. Hence, more than 3 million tonnes of furniture waste per year is generated.¹⁰

The manual released by the MoUD on MSW management in 2020 prescribed to extend EPR with the aim of minimising furniture waste in the country. This will strengthen the post-consumer mechanisms of furniture produce. Under EPR, second-hand furniture buyers can be easily linked with the sellers of used furniture.¹⁰

By 2024, the projected revenue to be generated from the Indian furniture market is US \$ 5.4 bn. The expected CAGR for the market from 2024 to 2029 is 6.42%. Per person revenue is expected to be US\$ 3.80 in 2024.¹⁰

Several companies have been working on producing recycled furniture have been listed below:¹⁰

1. Furniture Roots
2. Sunrise International

3. Furbicle
4. Kolkata wholesale furniture
5. Gharnish-Restaurant, Office and Home Furniture Makers
6. Rise Only
7. Sabharwals International Furniture
8. Reclaimed Wood Furniture Manufacturer
9. Jangid Arts & Crafts-Hand Painted Furniture Manufacturer
10. Shree Bohra International
11. Praveen industries
12. Vipul Furniture
13. Pure wood: Furniture Manufacturer

A report prepared by KPMG in collaboration with NSDC on 'Human Resource and Skill Requirements in the Furniture and Furnishing Sector in 2013-17 & 2017-22 cites the following.¹¹

The industry grew at a rate of 15% in 2013. For a large part of the previous decade, the industry focused more on the production of readymade and branded furniture. Most of the customer preference has been inclined towards quickly installable and customisable options.¹¹

The sector has suffered from a lack of competitive wages. Absolute consumption has remained very high but per capita consumption has remained low due to the existing income disparities until 2022. This sector also faces a shortage of raw material because of which manufacturing cost hikes up. The market has mostly stayed unorganised because of which the products have not been highly competitive especially in the global market.¹¹

According to ASSOCHAM, until 2022, there were 1419 registered furniture factories. Until 2012, only 1157 were active. Most of the employment has been distributed in the following states until 2022. The following table gives the details.¹²

Table 2: States & employment in furniture industries¹²

1. West Bengal	355,124
2. Uttar Pradesh	238,544
3. Maharashtra	203,124
4. Bihar	150,996
5. Gujarat	138,213

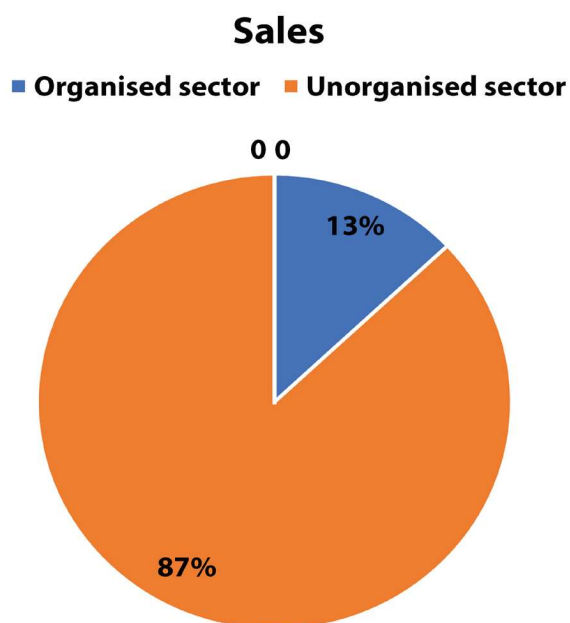
table cont....

6. Kerala	137,156
7. Odisha	122,181
8. Andhra Pradesh	117,997
9. Assam	104,121
10. Tamil Nadu	94,117
11. Rajasthan	83,652
12. Punjab	82,592
13. Karnataka	73,238
14. Madhya Pradesh	55,643
15. Rest of India	184,663
Total	2,141,362

About 50 percent of the work force has been mostly concentrated in West Bengal, Uttar Pradesh, Maharashtra, Bihar and Gujarat according to the 68th round of NSSO.

About 97% of the workforce are school drop outs. Nearly 88 % of these drop outs have been educated until the secondary level or less.

Until 2022, the composition of the workforce was as follows:



The furniture industry follows a four level value chain. These four levels are:

1. Procurement
2. Designing
3. Production
4. Distribution

Procurement level involves the acquisition of raw material. Designing and Production levels include the designing process of home, office etc. furniture and processing, assembling etc. of the furniture respectively. Finally, at the distribution level, direct sale, whole sale and retail sale of the finished product takes place.^{11,12,13}

India imports furniture from countries like China, Germany, Malaysia, Italy, UK, Thailand, Hong Kong, Sri Lanka etc.

Currently, the industry faces challenges like Labour shortage, absence of standardisation and certification, lack of skill development that matches the pace of technological development, and non-conducive government policies on the matters of raw material procurement, a high service tax, etc. A poor supply chain management, dependence on imports, lack of incentive and the unorganised nature of the industry.^{11,12,13}

Wooden furniture occupies the largest segment in the furniture product categories. Different types of wood like Sheesham, Teak, Rose wood etc. are used for making the furniture.^{11,12,13}

During the previous three decades, India has seen an enormous hike in deforestation. Between 2015-2020, India ranked second, after Brazil for a deforestation figure of 6,68,400 ha. This is an outcome of an increased population. Cattle rearing for meat and oil seed cultivation have been the major reasons behind forestry loss.^{11,12,13}

Forestry loss directly indicates a loss of wood as a raw material for furniture. This again poses a challenge for the industry.^{11,12,13}

Plastic is also used in the furniture industry. As per the 2017-18 reports of CPCB, plastic waste in India amounted to 9.4 million tonnes per annum out of which 5.6 million tonnes gets recycled.^{11,12,13}

About 70 percent of the waste is recycled at registered facilities, 20 percent is recycled by the unorganised sector, and the remaining 10 percent gets recycled at home in India. This recycled waste can become the raw material required in the production furniture.^{11,12,13}

Top global and Indian furniture brands currently in India are:^{11,12,13}

1. IKEA
2. Hometown

3. Durian
4. Damro
5. Natuzzi
6. FabFurnish
7. Herman Miller
8. GodrejInterio
9. Steelcase
10. Roche Bobois
11. BoConcept
12. Ashley Furniture Home Store
13. Prestige Furniture

As per the KPMG report, until 2022, there were 26 furniture producing clusters in India. There were total 1,419 registered furniture manufacturing units with 222 of them present in Maharashtra, 201 in Tamil Nadu, 124 in Rajasthan, 119 in Andhra Pradesh and 112 in Karnataka.^{11,12,13}

Four of the manufacturing clusters were present in UP, three in Kerala, one in Maharashtra, West Bengal Had one of them and finally, Bihar had one. Municipal directives on furniture waste mostly focus on waste segregation, collection, recycling, disposal, awareness, education, local variations etc.^{11,12,13}

DISCUSSION

The article starts with a case study on recycling of paper and moves on to the number of waste recycling plants that are installed in India as per the data provided by 'statista' based in Paris. Thereafter, it cites data from the Times of India on food wastage in India. Primarily, this data is based on the pattern of World Food Program.

Production of horticultural crops in India provided by the Press Information Bureau & the Business standard is the next forte of the article. The National Agricultural Market & the Agricultural Produce Market Committee are the next pivots or the central principle around which the article revolves around.

The Food & Agricultural Organization & the waste link provide solutions to the emerging issues of food wastage. IOWA University provides a solution through a healthy style of printing for students with an aim to save paper.

Management of Municipal Solid Wastes and

use of agricultural wastes to make furniture as highlighted by the World Economic Forum are the interesting but nagging issues that the article deals next.

Trade India provides data on the role of multiple stakeholders in furniture industry and the issue of deforestation in India by Down to Earth are the issues dealt at the tail end of this article.

CONCLUSION

The above-mentioned efforts of all the stakeholders, institutions, ministries at national & international partnerships aspires that the efforts sustain themselves through the roll out of the strategies, activities & efforts related to Swachh Bharat Mission 2.0. The critical issue of waste management in paper that is linked to deforestation are perennial issues that the individual & community deal with. This practice should be an ongoing process as it is linked to pollution in the four dimensions.

It is time that collaborative efforts & the experiences of all the stakeholders are shared, introspect & be used in turning these into doable actions. This effort will ensure that the ever important issues of waste management practices become better across the village, blocks, tehsil, district, states & the nation.

The challenge that lies ahead is the effective management of all types of wastes. While the nation has learnt to somewhat deal with the regular wastes of households, there is a lot to be done for the management of commercial wastes while protecting the fresh water body sources.

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