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Creating Innovative Solutions for a Sustainable Future

USED BEVERAGE CARTONS MANAGEMENT STUDY 2022

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Prepared for

Tetra Pak®

Prepared by

teri THE ENERGY AND RESOURCES INSTITUTE

Creating Innovative Solutions for a Sustainable Future

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Foreword

Tetra Pak is a world leading food processing and packaging solutions company. During its journey of over 70 years, with a sustained focus on innovation, Tetra Pak has actively engaged in various initiatives to protect food, people, and the planet aligning their activities with the Sustainable Development Goals (SDGs). With the sole purpose of comprehending the management of used beverage cartons, Tetra Pak is dedicated to ensuring the safety of food and the well-being of future generations.

Tetra Pak has adopted a proactive and pioneering approach to ensure the collection, sorting, and recycling of cartons, thereby sustaining their value. A well-functioning recycling value chain not only preserves the environment but also prevents littering, conserves resources, and mitigates climate impact—contributing to the creation of a sustainable future. Around 70% of Tetra Pak cardboard is made from long, strong paper fibres that can be recycled several times into paper products. The thin layer of polymer or plastics in beverage cartons can be blended with other polymers or with the aluminium component and turned into new products such as roofing tiles, crates, industrial pellets, and more.

With a view to strengthening the recycling chain and updating on the sustainability front, Tetra Pak has an internal mandate to conduct UBC management studies every three years. As a part of this exercise, TERI has offered its services to conduct surveys and also analyses UBC management in 24 cities across India along with Bangladesh and Nepal.

In this regard, TERI conducted primary survey with various stakeholders across the value chain. Earlier also, studies were done by TERI in 2011, 2015, 2019, and 2020. Currently, there is a need of study to understand recycling rates in 24 cities, for which, a robust study using statistical tools and analysis is being undertaken by TERI for Tetra Pak India Pvt. Ltd. (TPIPL). Tetra Pak has been doing voluntary EPR for more than 15 years now and has been continuously working with recyclers across South Asian region to develop solutions, technologies, and applications.

We laud the efforts of corporates such as Tetra Pak who come forward voluntarily to commission such comprehensive studies. TERI has carried out a study for TPIPL with the support of local partners and Urban Local Bodies and the findings have been shared in the report. We think this type of scientific and rigorous study will eventually add value and enable Tetra Pak in formulating appropriate strategies to enhance the recycling rates of UBCs and help achieve the SDGs.

I do hope that the recommendations of the study will get translated into action and the report will interest policymakers, regulators, utility officials as well as different consumer groups on the waste handling aspect of the environmental value chain.

Vibha Dhawan, PhD
Director-General, TERI

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List of Abbreviations

CPCB	Central Pollution Control Board
CPPRI	Central Pulp & Paper Research Institute
DWCC	Dry Waste Collection Centre
EPR	Extended Producer Responsibility
GHG	Greenhouse Gas
GMC	Guwahati Municipal Corporation
HPPCB	Himachal Pradesh Pollution Control Board
INR (₹)	Indian Rupee
JKSPCB	Jammu and Kashmir State Pollution Control Board
KMC	Kochi Municipal Corporation
MoHUA	Ministry of Housing and Urban Affairs
MoEFCC	Ministry of Environment, Forest and Climate Change
MLP	Multi-Layer Packaging
MSW	Municipal Solid Waste
NGO	Non-Governmental Organization
NMC	Nagpur Municipal Corporation
PCC	Post-Consumer Cartons
PE	Polyethylene
PMC	Pune Municipal Corporation
RCF	Recycled Cellulose Fibre
SDG	Sustainable Development Goals
TERI	The Energy and Resources Institute
TMC	Thiruvananthapuram Municipal Corporation
TPA	Tonnes per Annum
TPIPL	Tetra Pak India Private Limited
UBC	Used Beverage Carton
USD	United States Dollar
WtE	Waste to Energy

Executive Summary

Tetra Pak beverage cartons enable the distribution of liquid and food items by providing optimal shelf life which helps in maintaining the freshness, flavours, and nutritional content of such products under ambient temperature or refrigerated conditions. The rising popularity of packaged food and products is driving the demand for such cartons. The global average market for beverage cartons was valued at USD 16.51 billion in 2020, and it is anticipated to reach USD 22.44 billion by 2028. Beverages cartons are categorized as paper-based packaging and are made of approximately 70% paperboard, 25% polymers, and 5% aluminium. The cartons made of long, strong paper fibres provide strength and stability, and can be recycled several times into paper products. The thin layer of polymer or plastics in beverage cartons can be blended with other polymers or with the aluminium component and turned into new products such as roofing tiles, crates, industrial pellets, and more. Each material component of beverage cartons is recyclable if processed properly along the value chain.

In India, Tetra Pak started its operations in 1987 creating numerous job opportunities and introducing advanced technology tailored for the Indian market. Over the last 30 years, the company has introduced and advanced many packaging formats in different sizes and prices to suit consumer requirements. However, with the increasing demand and consumption of these cartons, the environmental effects, such as littering, energy consumption, and greenhouse gas emissions, cannot be ignored. To mitigate these effects, Tetra Pak actively engages in collection, sorting, and recycling of used cartons to prevent them from ending up in landfills. Through its recycling efforts, Tetra Pak not only helps reduce the burden on landfills but also contributes to the conservation of valuable natural resources, such as paper fibres. By recovering and recycling paper from used cartons, Tetra Pak promotes a more sustainable and circular approach to packaging, wherein materials are reused and repurposed, thereby minimizing the need for virgin resources. Tetra Pak's commitment to environmental sustainability extends beyond recycling initiatives. The company continues to invest in research and development to further reduce the environmental footprint of its packaging materials and processes. This includes efforts to enhance the recyclability of cartons, reduce energy consumption in production, and minimize greenhouse gas emissions throughout the entire lifecycle of its products. Tetra Pak has been fulfilling its extended producer responsibility (EPR) voluntarily for more than 18 years and has been continuously working with recyclers across the South Asian region to develop solutions, technologies, and applications for UBCs. Through constant interactions and partnerships with recyclers, Tetra Pak aims to improve the level of active sorting of UBCs and reduce mixed waste recycling, making the recycling process more effective, efficient, and economical.

As part of a strong commitment of Tetra Pak to protect the planet and promote a low carbon circular economy, Tetra Pak continues to strengthen the collection and recycling chain for used beverage cartons, and in this regard, Tetra Pak conducts a UBC management study every three years to get a status update on the infrastructure efforts and design appropriate interventions to further strengthen the ecosystem. This study was commissioned to The Energy and Resources Institute (TERI), India for Tetra Pak India Private Limited (TPIPL) with the sole objective to understand and analyse the management of UBC in 22 Indian cities. Earlier, the studies were conducted in 2011, 2015, and 2018. The overarching objective of the study was to explore the perceptions of waste collectors on UBC management and evaluating the quantity of UBCs collected for recycling with mixed paper waste through small scale and large-scale

dealers to formulate appropriate strategies for enhancing the recycling rates of UBCs.

The sub-objectives of the study included:

- Study the current quantum of Tetra Pak UBC getting procured/retrieved at the waste dealers' level.
- Understand the value chain and the economics involved in Tetra Pak UBC collection and recycling.
- Assess the actual quantum of Tetra Pak UBC reaching the paper mills which recycle paper from low grade paper waste.
- Assess the quantum of pulping rejects from low-grade paper waste at paper mills.
- Understanding the composition of paper waste and quantity of Tetra Pak UBC reaching dumpsites in the surveyed cities covering one vehicle each from domestic, commercial, and institutional area.
- Gauge, what critical stakeholders (low grade paper waste dealers and recycling paper mills) believe, is needed to upscale collection and recycling– economics, awareness, infrastructure, etc.

The methodological approach involved identifying cities with the highest sales of beverage cartons spread across the Northern, Southern, Eastern and Western parts of India, conducting primary survey with various stakeholders across the value chain. The sample size per city included 22 waste collectors, 14 small-scale dealers, and 7 large-scale dealers. The primary survey was carried out through questionnaire seeking information from stakeholders involved in the management of UBCs across the cities. The survey also included 10 recyclers/ paper mills across India using mixed paper waste to understand the fate of UBC being received at the paper mills within mixed paper fractions. Analysis at the dumpsites was conducted in each of the identified cities to quantify the amount of UBCs reaching the disposal sites/landfills. Local agencies/NGOs engaged actively in the field of solid waste management were identified with the help of TPIPL in each city to carry out on ground data for collection and survey.

The study revealed that UBCs are being collected by ragpickers, small-scale waste-paper dealers, and large-scale dealers and are then sent to recycling units. The outcomes of the study revealed the percentage of large-scale dealers dealing with UBCs and it is found that in cities like Kochi, Chandigarh, Shimla, Delhi, Lucknow, Pune, Kolkata, Mumbai, and

Chennai 100% of the surveyed large-scale dealers were engaged in the collection of UBCs indicating an enhanced collection rate and further sending it to recyclers/paper mills for processing, thereby reducing the amount of UBCs reaching the landfill sites.

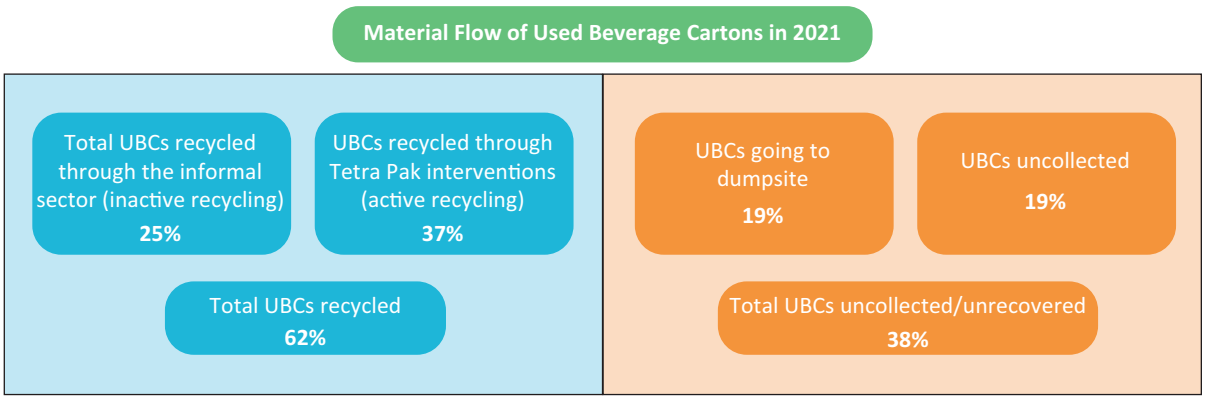
According to the Ministry of Housing and Urban Affairs (MoHUA), in 2021 roughly 7% of municipal solid waste (MSW) consisted of paper and cardboard waste with an estimated recovery rate of 60%. The quantity of paper and cardboard which was recovered in 2021 was 2,222,850 tonnes,[1] which corresponds to nearly 57% recovery. Hence, the paper recovery rate for waste paper in India is assumed at 57% for calculations within this report.

Further to this analysis, material flow of used beverage cartons was developed to analyse the quantum of UBC reaching the landfill site and UBC being recycled through inactive (informal sector) and active recycling (through interventions of Tetra Pak). It was observed that 62% of the total UBCs are getting recycled whereas the remaining 38% are uncollected or unrecovered. The detailed material flow analysis is depicted below.

Thus, as a part of this study, the value chain and economics involved in the collection and recycling of UBC were identified and was observed that the recycling rates of UBCs have increased over the past studies conducted in 2011, 2015 and 2018 wherein the recycling rate where 29%, 43% and 54%, respectively. The recycling rate obtained during the course of study for post-consumer cartons (PCC) is 62%, owing to the interventions of Tetra Pak in collaborating with various recyclers in strengthening the collection and recycling of UBCs by providing adequate infrastructure and technological solutions for dealing with UBCs along the value chain. As a result, the disposal of UBCs mixed with paper at dumpsites has decreased, and a separate collection and recycling chain for UBCs has been strengthened. Further, based on the extrapolation of data along with secondary research and consideration of over 1000 cities, (based on Central Pollution Control Board waste recovery data on pan-India level, population Census, and paper recovery rate) in India, the overall national recycling percentage is about 45%, implying that for every two UBC, one is recycled.

On the basis of the analysis conducted for each city, few of the key recommendations that can enhance the recycling rate of used beverage cartons are suggested below:

1. Over the last 3 years, Tetra Pak India's interventions have enabled an increase in the formalized active collection rates in multiple cities. The resilience of this model is strengthened if informal sector and UBC market is well established amongst all the



[1] https://mohua.gov.in/upload/whatsnew/627b833ecac62Circular-Economy-in-waste-management-FINAL.pdf

small- and large-scale dealers. Active collection of UBCs and collaborating with recycling units can help in promoting the collection and recycling of UBCs across the value chain. Hence, it is important to develop a stronger network of waste dealers as waste collectors are willing to collect UBCs if they receive better economic returns.

2. About 25% of the generated UBCs are getting recycled inactively in the informal chain along with other mixed waste paper categories, which demonstrates the high recycling potential of the cartons and the high value of the fibre content. Therefore, it should be recognized as a separate category within multilayer plastic packaging waste to facilitate further expansion in recycling. This is also in line with the recent EPR guidelines of the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, to promote recycling for recyclable formats as a preferred approach rather than end of life solutions.
3. Chandigarh, Pune, Mysuru and Bengaluru have a recycling rate (both active and informal combined) of over 90%. This high recovery rate can be attributed to the dedicated work undertaken by Tetra Pak India partner organizations in these cities. It was observed that these cities have a dedicated UBC collection centre. A similar model may be replicated or attempted in other cities of higher UBC generation such as Kolkata and Ahmedabad.
4. The acceptability of UBCs by the paper mill is essential in establishing a proper market for acceptability of UBCs amongst waste dealers. This could be achieved through awareness generation and segregation of UBCs at the source itself, along with advancement in technological solutions and infrastructure. In order to produce good grade quality of paper, the waste dealers should ensure provision of clean materials to paper mills.
5. It was also observed that the UBC market was better established in cities which were within a radius of 300 km from a paper mill as the cost of transporting UBC to paper mills was significantly less. Cities such as Jammu, Srinagar, Dharamshala find it difficult to transport UBCs to Tetra Pak partner paper mills, while the paper mills within their vicinity do not have the technology to recycle the multi-layer packaging of UBCs. Hence, in order to increase the recyclability of UBCs pan-India, setting up smaller machines within the existing paper mills to recycle UBC can also be explored.
6. Majorly, of all the cities surveyed, the key challenges as highlighted by waste collectors, small-scale dealers and large-scale dealers for not engaging in the collection of UBC was the lack of awareness on segregation of UBCs at source level. Active efforts by the stakeholders involved across the value chain such as government, non-governmental organizations, and industries can overcome this gap and could enhance the collection and recycling rate of UBCs that are littered and do not enter the value chain. The potential of this is massive and may help achieve a recycling rate of over 70%, since in 2021 almost 19% of the UBCs remained unaccounted.
7. In cities such as Delhi, Faridabad, Hyderabad, Srinagar, Lucknow, Pune, Mysuru, Chennai, Mumbai, Kurnool, Bengaluru the amount of UBCs reaching dumpsites have reduced substantially in comparison to the previous study conducted in 2018, because of improved collection and recycling infrastructure of UBC. Increase in the prices of UBCs along with mixed paper also supported the increase in collection.
8. The study and management of UBCs to identify the collection and recycling rate should be repeated every three years to assess the improvements in the active and inactive recycling rates. This will help Tetra Pak in increasing collection and recycling and thus enable to achieve better efficiency, which is in sync with the Government of India's vision as well.
9. There is a need for developing market/ opportunities for recycled products made of UBCs to further lead to increase in collection and recycling percentage for UBCs.

Introduction

Tetra Pak is a multinational food packaging and processing enterprise, a sub-company of Tetra Laval Group, with head office in Switzerland. The company offers packaging, filling machines and processing for dairy, beverages, cheese, ice-cream and prepared food, including distribution tools such as accumulators, cap applicators, conveyors, crate packers, film wrappers, line controllers, and straw applicators.

About Beverage Cartons

Every day, billions of litres of liquid food such as milk, juice, and water are consumed globally. Liquid foods are placed in beverage cartons, a type of packaging that is commonly used to protect fresh food and drinks. Beverage cartons can be recycled and are being recycled more frequently by recyclers across the world. Tetra Pak is a provider of food processing and packaging solutions that offers consumers high-quality, cutting-edge goods that are also environmentally friendly. Tetra Pak beverage cartons enable the distribution of liquid and food items by prolonging its shelf life through maintaining the freshness, flavours, and nutritional content of such products. Long, strong paper fibres that can be recycled multiple times into other paper products make up more than 70% of the beverage cartons. Tetra Pak provides packaging supplies to more than 8,800 packaging machines across the world.[1]

We use beverage cartons on a daily basis. The need for such cartons is driven by the rising popularity of packaged food and beverage products. The market for beverage cartons was valued at USD 16.51 billion globally in 2020, and it is anticipated to reach USD 22.44 billion by 2028.[2] With this rising demand, it is also important to take into account the environmental effects of used beverage cartons, such as littering, the energy consumed to produce virgin materials for making new cartons, the greenhouse gases (GHGs) emissions, and so on.

Tetra Pak aseptic paper-based beverage cartons are categorized as paper-based packaging because they primarily consist of 70% paperboard, 5% aluminium, and 25% polymers. The paperboard and other layers, viz., aluminium, polymers and plastics are separated using re-pulping techniques. The beverage cartons made of paper are completely recyclable. The thin layer of polymer or plastics in beverage cartons can be blended with other polymers or with the aluminium component and turned into new products such as roofing tiles, crates, industrial pellets, and more, while the separated paper fibres can be turned into new paper products. Not only does Tetra Pak work hard to improve its packaging, but it also takes proactive measures to protect the environment. Tetra Pak has helped establish UBC collection points in numerous cities and works to educate the public through initiatives that focus on education, information, and capacity building.

Beverage Carton Consumption in India

Tetra Pak was one of the first carton packaging companies in India, established in 1987, with a dedication to keeping food safe and accessible across consumer segments with its reach extending to the most remote locations. It produced numerous employment prospects. The business invested in modern technologies that were tailored for the Indian market. Tetra Pak's major goal is to improve the lives of as many people as possible by providing food that is

[1] https://www.tetrapak.com/en-in/solutions/packaging
[2] https://www.fortunebusinessinsights.com/beverage-cartons-market-105450

both accessible and sustainable. Tetra Pak India is one of the market places with the quickest growth rates worldwide and is well ahead of many other nations.

Different types of Tetra Pak packages

Tetra Pak introduced several packaging materials and formats for storing different types of food and beverages. The redesigned packages contain a new format and additional materials such as tethered caps. Additionally, the packaging are now equipped with QR codes, which turn them into data carriers that can increase customer interaction and raise food safety. Offering paper-based straws and plant-based plastic layers and caps made of sugarcane is another example of how the renewable content in packaging is growing.

These packages offer better functionality and are much more appealing, which increases consumer appreciation. They come in a variety of shapes, are space-saving, and were created with consumer preferences in mind. This makes recycling much more practical and benefits the economy while also enhancing the environmental performance of packaging.

Share of Paper-based Beverage Carton Market in India

Tetra Pak is a pioneering and major manufacturer of beverage cartons in India with its production facility situated in Chakan, Pune. Several large Indian brands have partnered with Tetra Pak like Nandini, Dabur, Parle Agro, Amul, ITC and Paper boat. Products like "Amul milk" and "Nandini Goodlife milk" are packed in Tetra Pak beverage cartons which help in providing safe liquid milk to the remote areas in northern and southern parts of India.

Over the past 35 years, a variety of packaging types have been developed and presented in various sizes, and these packages are sold at various prices to accommodate various consumer needs.

Manufacturing Process of Beverage Cartons

Before the beverage cartons are ready for consumption at the nearest marketplace, they go through various stages of production. Tetra Pak beverage cartons are multi-layered packaging substances having six layers in total:

- a polyethylene (PE) waterproof layer that also makes the product's contents antibacterial;
- a layer of paperboard to boost the package's stability and resistance;
- a layer of PE acting as a binding layer;
- a layer of aluminium to prevent oxygen, light, and smell permeation;
- a layer of PE acting as a binding layer;
- and a layer of PE protecting the product's contents.

Paperboard, which is derived from wood pulp, is one of the most crucial and significant parts of a carton. Using a paperboard machine, the pulp is washed and then combined together to create multiple layers. The control processes in place are used to assess the material's thickness, stiffness, and smoothness. There are several types of paperboards available depending on the size of the carton, the distribution method (whether refrigerated or ambient), and the shelf life of the product to be made. Table 1 represents the list of products for which beverage cartons are manufactured and used for packaging.

Sustainability Requirements

Lack of efficient solid waste management in today's world is posing a menace to the environment as well as public health. Tetra Pak promotes circular solutions in this regard by developing recyclable liquid food packaging, utilizing recycled and renewable resources, and enhancing collection and recycling to keep

TABLE 1 List of few products for which used beverage cartons are manufactured

Sl. No.	Sector	Product
1.	Dairy	UHT milk
		Pasteurized and ESL milk
		Cream
		Fermented dairy products
		Concentrated and condensed milk
		Other dairy products
		Recombined milk
		Flavoured and formulated dairy products
2.	Beverages	Juice
		Still drinks
		Particle drinks
		Carbonated soft drinks
		Soy
		Tea
		Coconut water
3.	Prepared food	Soups tomato, baby food, sauces
		Fruit preparations
		Desserts

Source: Tetra Pak

materials in use and out of landfills. In 2021, Tetra Pak spent €40 million, globally on infrastructure for collecting and recycling, resulting in the collection and delivery of 50 billion cartons to recyclers.[3]

Tetra Pak places a great emphasis on the three key areas of "Food, People, and Planet" and firmly supports sustainability and related preventive measures. The company's stated goal is to do business sustainably over the long term, putting equal emphasis on the economic, environmental, and social spheres. The company makes sure that food, people and planet are protected, and it directs its efforts towards the Sustainable Development Goals (SDGs) (Figure 1). Various works in this approach have been done during the past few years. Tetra Pak offers environmentally sound food packaging and their ambition is to create the world's most sustainable food package–one that is fully renewable, fully recyclable, and carbon neutral. With the current paper-based recyclable package, the company is well on its way to realizing this ambition.

In order to give people a sustainable environment, new approaches and concepts must be developed, including ones that takes into account consumer requirements and interests. Helping people and

[3] https://www.tetrapak.com/en-in/sustainability/sustainability-updates

FIGURE 1 Figure depicting SDGs being followed

communities operate their marketplaces, value chains, and businesses in a sustainable and environmentally responsible manner is necessary.

Post-consumer Recycling

The major sustainability criterion for packaging is its ability to be recycled and to prevent its leakage into the environment. To ensure that the cartons are collected, sorted, and recycled, Tetra Pak is actively involved and has launched a number of initiatives. A few of Tetra Pak's environmental initiatives in India are the 'Alag Karo' programme and the 'Go Green with Tetra Pak' campaign. The Alag Karo initiative was a behavioural change and awareness campaign to institutionalize source segregation in Gurugram's housing developments, educational institutions, and workplaces. To create a Model Ward for Sustainable Waste Management, Alag Karo 2.0 was designed. As the Alag Karo programme was a "trend-setter" for waste management programmes, the Ministry of Housing and Urban Affairs (MoHUA) propagated the adoption of 'Alag Karo' in all municipal corporations across the country as a communication tool for waste management

Go Green with Tetra Pak is a collaborative partnership among Tetra Pak India, RUR Greenlife and Sahakari Bhandar and Reliance Smart & Fresh retail chain of stores to install Tetra Pak carton drop off points to encourage recycling. More than 230 deposit terminals

were established by the project throughout Mumbai, including 54 Sahakari Bhandar, Reliance Fresh, and Reliance Smart outlets. Through this effort, more than 11,000,000 cartons have been collected since 2010 and underprivileged schools received more than 500 school tables and 100,000 other things produced entirely from the recycled cartons.

Through a network of over 30 partners, Tetra Pak promotes collection and recycling of post-consumer packaging waste using simple techniques. Along with the 70% strong fibre sheet, the aseptic paper-based beverage carton includes a thin layer of polymer or plastics in beverage cartons which can be recycled by blending with other polymers or with the aluminium component and turned into new products such as roofing tiles, crates, industrial pellets, and more.

Recycling helps maintain the usage of valuable resources and promotes a circular economy with low carbon emissions. Additionally, it lessens the influence on the environment and helps prevent littering. Figure 2 depicts the recycling process for used beverage cartons (UBCs).

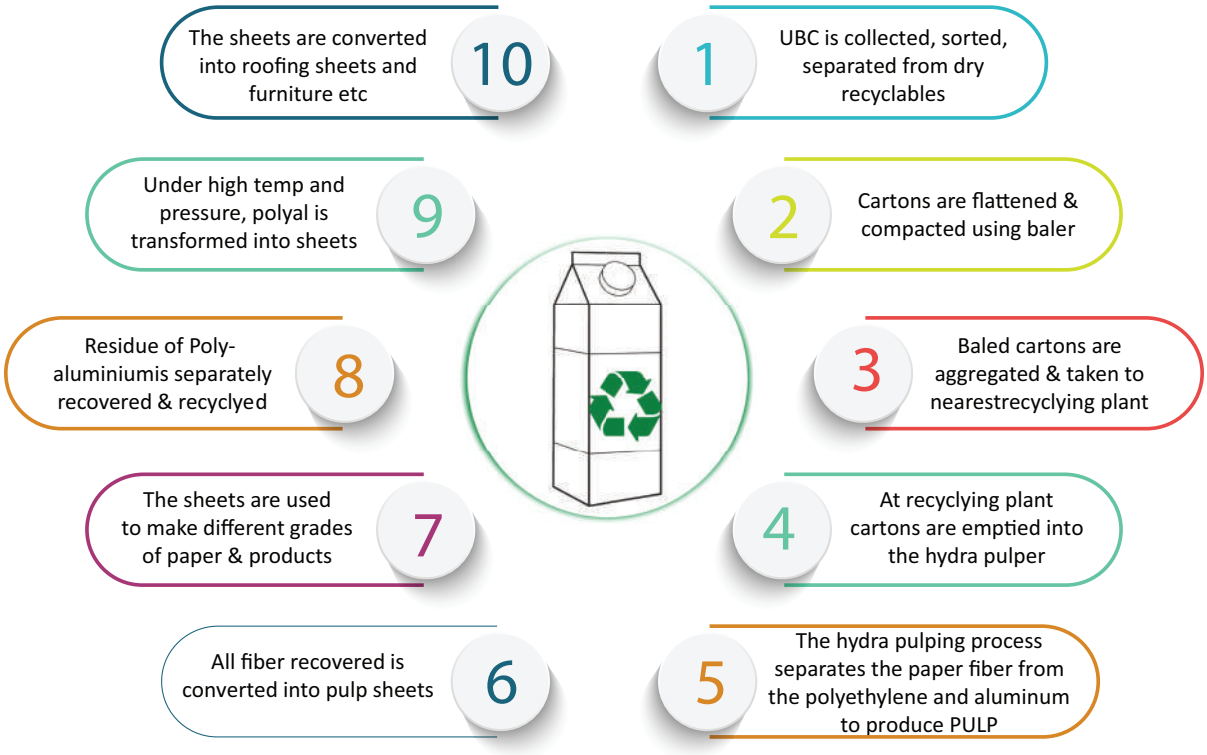


FIGURE 2 Recycling process of cartons followed

Objectives and Research Methodology

The primary objective of this report is to document the field observations as witnessed by TERI team while visiting each of the cities and paper mills. The report has been divided into 6 sections.

- The first section introduces the project and provides a breakup of the report.
- The second section provides the objectives of this project report and also breaks down the methodology used in developing the report.
- The third section details out the findings and observations at different stakeholder level such as waste collectors, small- and large-scale dealers along with the dumpsite analysis in all 22 cities.
- The fourth section presents the paper mill analysis undertaken as part of this study.
- The fifth section provides the economic analysis, survey analysis and calculates the recycling rates, along with estimating UBC waste at landfill. This section also covers the material balance analysis.
- The sixth section concludes the report and compares the findings of 2021 with the results of previous two studies. Additionally, this section also provides key recommendations for improving the UBC value chain.

Objective

Tetra Pak has taken a proactive and pioneering approach to make sure cartons are collected, sorted and recycled so that they keep delivering value. When a recycling value chain is working well, it also prevents littering, saves resources and reduces climate impact, building a sustainable future. Around 70% of Tetra Pak cartons are made from long, strong paper fibres that can be recycled several times into paper products. The thin layer of polymer or plastics in beverage cartons can be blended with other polymers or with the aluminium component and turned into new products such as roofing tiles, crates, industrial pellets, and more.

With a view to strengthen the recycling chain and update on sustainability front, Tetra Pak has an internal mandate to conduct UBC management study every three years.

As part of a strong commitment of Tetra Pak to protect the planet and promote a low carbon circular economy, Tetra Pak continues to strengthen the collection and recycling chain for used beverage cartons, and in this regard, Tetra Pak conducts a UBC management study every three years to get a status update on the infrastructure efforts and design appropriate interventions to further strength the ecosystem. Additionally, as a part of this exercise, TERI has offered its services to conduct surveys and analyse UBC management in 22 cities across India. Earlier studies were done in 2011, 2015, 2018, and 2021. Currently, there is a need to understand the ongoing recycling rates in 22 cities, for which, a robust and focussed study using statistical tools and analysis is being undertaken by TERI team for Tetra Pak India Pvt. Ltd. (TPIPL).

Under the guidance of TPIPL, the 22 identified cities are tabulated in Table 2.

The sub-objectives of the study are as follows:

- Study the current quantum of Tetra Pak UBC getting procured/retrieved at the waste dealers' level.
- Understand the value chain and the economics involved in Tetra Pak UBC collection and recycling.

TABLE 2 List of surveyed cities

Sl. No.	City	State/Union Territory
1.	Delhi	National Capital Territory of Delhi
2.	Lucknow	Uttar Pradesh
3.	Srinagar	Jammu and Kashmir
4.	Jammu	Jammu and Kashmir
5.	Kolkata	West Bengal
6.	Guwahati	Assam
7.	Ahmedabad	Gujarat
8.	Mumbai	Maharashtra
9.	Pune	Maharashtra
10.	Nagpur	Maharashtra
11.	Hyderabad	Telangana
12.	Bangalore	Karnataka
13.	Mysuru	Karnataka
14.	Chennai	Tamil Nadu
15.	Chandigarh	Union Territory of Chandigarh
16.	Faridabad	Haryana
17.	Shimla	Himachal Pradesh
18.	Dharamshala	Himachal Pradesh
19.	Kurnool	Andhra Pradesh
20.	Bhubaneswar	Odisha
21.	Kochi	Kerala
22.	Thiruvananthapuram	Kerala

- Assess the actual quantum of Tetra Pak UBC reaching the paper mills, which recycle paper from low grade paper waste.
- Assess the quantum of pulping rejects from low grade paper waste at paper mills.
- Understanding the composition of paper waste and quantity of Tetra Pak UBC reaching dumpsites in the surveyed cities covering one vehicle each from domestic, commercial, and institutional area.
- Gauge, what critical stakeholders (low grade paper waste dealers and recycling paper mills) believe, is needed to upscale collection and recycling–economics, awareness, infrastructure, etc.

Research Methodology

The methodology involves selecting cities throughout the country's South, North, East, and West regions that have the highest sales of beverage cartons. The overall study components are shown in Figure 3.

The UBC management study determined the recycling rates with the help of secondary research and field surveys (with waste collectors, waste dealers, and

at paper mills). The survey also gathered data on economics of the UBC/mixed paper managed in each city. The study's findings are reported later in this report. The analysis at the dumpsite assisted in determining the proportion of paper waste and UBCs that were reaching the disposal site.

FIGURE 3 Study approach for assessing UBC management

Findings and Observations

As part of the project, 22 cities were completed for Tetra Pak. For this, the travels were undertaken as follows (Table 3):

TABLE 3 Details of visit to different cities

Sl.No.	City	Date of visit	Local partner
1	Delhi	17th June to 20th June	Change Human Foundation
2	Srinagar	19th June to 23rd June	ENGAGE
3	Guwahati	22nd June to 26th June	Earth Recycler
4	Jammu	24th June to 29th June	ENGAGE
5	Faridabad	27th June to 30th June	Change Human Foundation
6	Dharamshala	30th June to 4th July	Waste Warriors
7	Shimla	5th July to 8th July	Gurditta Informatics
8	Kolkata	6th July to 9th July	Earth Recycler
9	Bhubaneswar	6th July to 10th July	Shree Ganesh Recycling Private Limited (SGR)
10	Chandigarh	10th July to 14th July	Gurditta Informatics
11	Thiruvananthapuram	14th July to 17th July	Green Worms
12	Kochi	18th July to 22nd July	Green Worms
13	Mysuru	23rd July to 2nd August	Isha Fibres
14	Bengaluru	27th July to 2nd August	Isha Fibres
15	Hyderabad	3rd August to 6th August	Sukuki Exonora
16	Nagpur	6th August to 10th August	Centre for Sustainable Development
17	Kurnool	8th August to 11th August	Dalit Bahujan Resource Centre
18	Chennai	12th August to 16th August	Earth Recycler
19	Ahmedabad	23rd August to 26th August	Shriman Enterprises
20	Lucknow	1st September to 5th September	AIM Trust
21	Pune	4th September to 8th September	Shriman Enterprises
22	Mumbai	9th September to 12th September	Sampurn Earth

The individual field reports and the city-specific observations of TERI team while visiting each of the above-mentioned cities is captured in the following section.

Delhi

Waste Collectors

Twenty-four waste collectors were interviewed in the city, including door-to-door waste collectors (50%) and ragpickers (70%) covering residential, commercial, hotel, and institutional areas. The collectors deal with paper (100%), plastics (100%), glass (83%), metals (83%), cardboard (96%) as well as Styrofoam (79%). About 33% of door-to-door collectors were collecting UBC out of which 54% of them collect UBC along with mixed paper waste. Seventy-one per cent of waste collectors were not engaged in the collection of UBC as there was no incentive in UBC collection, the market for UBC was also missing and no one returned UBC to them.

The average UBC collected per month ranged from 120 kg/month to 1800 kg/month at a price of ₹4–12/kg. The quantity and price of UBC collection has increased in the past three years through consistent efforts from Tetra Pak and their partner organization as well as improved infrastructure for better waste value chain of UBC. The mixed paper was reported to be collected 300 kg/month to 2500 kg/ month for a price of ₹8–10/kg. The source of procurement of mixed paper included households (66%), streets (50%), waste bins (37%), and markets (46%). The source of major UBC generation was reported from commercial or business establishments (50%), upper and middle class localities (37%), and low income groups (12%). Around 20% of the respondents claimed that the UBC mostly contained leftover juice, 29% said that they are soiled while the remaining said that the collected UBCs were clean and ready for sale.

The major concerns as highlighted by waste collectors for dealing with UBC separately were:

» Lack of buyers in market

» Low price for UBC collection

» Lack of space for storage

FIGURE 4 Waste collector interviewed during survey, Delhi

» Less quantity and low weight of UBC

Waste collectors' response to the ways by which collection can be improved included:

» Awareness amongst the stakeholders on the recyclability of UBC,

» Dealers should buy UBC with good rate

» Establish a market to sell the collected UBC.

Small-Scale Waste Dealers

Fifteen small-scale dealers were surveyed across the city covering residential, hotel, hospital (AIIMS), commercial, and institutional areas. The numbers of ragpickers/kabadiwaalas contributing to each of these dealers were around 4–50. The average mixed waste paper handled by these dealers was in the range 200 kg/month to 50,000 kg/month. The purchase prices of mixed paper were indicated in the range of ₹5–12/kg and mixed paper selling prices were indicated in the range of ₹9–26/kg. All of the small-scale dealers were engaged in the collection of UBC wherein, 20% of the dealers collected UBC separately and the remaining collected along with the mixed paper waste. The purchase price of UBC were indicated in the range of ₹4–7/kg and selling prices were indicated in the range of ₹7–8/kg. The source of procurement of UBC included households (68%), ragpickers (62%), door-to-door

FIGURE 5 Small-scale dealer interviewed in Delhi during survey

collectors (37%), and intermediate kabadi (50%). The condition of the procured UBC was reported as 25% were in soiled condition whereas 50% were ready and clean for sale. None of the small-scale dealers were involved in the processing of UBC before selling.

The challenges as highlighted by small-scale dealers for not dealing with UBC were:

- Lack of buyers in market
- Low rates of UBC offered
- UBCs require large storage space
- No incentives for UBC collection

When asked how the collection of UBC can be improved, the dealers suggested the following:

- Awareness generation about the recyclability of UBC among the stakeholders
- Incentive or goods prices should be offered for the collection of UBC

TABLE 4: Bale analysis of small-scale dealers conducted in Delhi

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale scrap dealers	250	3	1.200
	253	1.7	0.672
	400	3.4	0.850
	257	3.8	1.479
	229	1.5	0.655
	28	1.1	3.929
	405	1.2	0.296
	340	3.7	1.088
	280	1.87	0.668
	250	2.3	0.920
	400	1.9	0.475
	340	7.6	2.235
	158	1.2	0.795
	176	1.4	0.759
	85	7.6	8.941
Total	3851	43.27	1.124

Large-Scale Dealer

Seven large-scale dealers were surveyed dealing in residential, commercial, and institutional areas. Around 20–250 kabadi/rag picker contributed to these large-scale dealers. The average mixed paper waste collected per month ranged from 30,000 kg/month to 150,000 kg/month. All of the surveyed large-scale dealers collected UBC, out of which 57% collected UBC separately, while 43% collected along with the mixed paper waste. The purchase price of mixed paper was indicated as ₹8–12/kg, whereas the selling prices were ₹8–18/kg. UBC collected per month was recorded in the range of 2,000 kg/month to 40,000 kg/month. The purchase price of UBC varied in the range of ₹4– 8/kg and sold along with the mixed paper waste at the rate of ₹8–18/kg. The source of procurement of UBC included households (83%), ragpickers (83%), door-to-door collectors (66%), intermediate kabadiwallah (83%) and commercial institutions such as hotels, shopping malls, markets, etc. (100%). Around 50% of the dealers reported condition of UBC as soiled, 33% reported as clean and ready for sale whereas 16% reported UBC with leftover juice inside the packs. Nearly 66% of the large-scale dealer mentioned that the UBC were sold to other large-scale dealers such as Green Recycle Links (GRL), a partner of Tetra Pak,

FIGURE 6 Analysis at large-scale dealer in Delhi

who further send it to paper mills. Nearly 33% of the dealers mentioned that sometimes straws are found in a pack and are sold with the plastic because with the plastic the selling price increases.

The challenges as highlighted by large-scale dealers in collection and recycling of UBC were as follows:

- Low price
- Space constraints
- Lack of incentives
- Less quantity collected

The suggested improvements by large-scale dealers were as follows:

TABLE 5: Bale analysis of large-scale dealers conducted in Delhi

Category	Weight of mixed paper waste bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Large-scale scrap dealers	404	4.95	1.225
	427	7.95	1.862
	368	2.5	0.679
	357	3.05	0.854
	400	6.5	1.625
	229	1.6	0.699
	350	6.3	1.800
Total	2535	32.85	1.296

» Source segregation at generation level required
» Higher price should be offered similar to that duplex paper
» Proper infrastructure for storage
» Better policies and awareness

Dumpsite Analysis

The dumpsite analysis was conducted at the Ghazipur landfill site. Three trucks were unloaded at the dumpsite with waste from residential, commercial, and institutional areas of Delhi. The trucks contained municipal waste from which the mixed paper waste and UBCs were segregated and weighed.

FIGURE 7: Dumpsite analysis at Ghazipur landfill site, Delhi

TABLE 6: Dumpsite analysis conducted in Delhi

Truck	Total truck load	Mixed paper waste	UBC found in paper waste
Truck 1	16,000 kg	20 kg	1.00 kg
Truck 2	9000 kg	15 kg	0.5 kg
Truck 3	8000 kg	10 kg	1.5 kg

Srinagar

Waste Collector

Twenty-two waste collectors were interviewed across the city, including door-to-door waste collectors (4%) and ragpickers (96%) covering residential, commercial, and institutional areas. The collectors deal with paper (100%), plastics (100%), metals (10%), and cardboard (10%) as well as glass (23%). Around 27% of waste collectors were collecting UBC along with mixed paper waste whereas 73% were not engaged in the collection of UBC as there was no incentive in UBC collection (68%), the market for UBC was also missing (68%) and no one returned UBC to them (9%). The average UBC collected by each of these dealers varied from 2 kg/month to 150 kg/month. The mixed paper was reported to be collected 300 kg/month to 2500 kg/month. The selling price of UBC has been indicated as ₹6/kg whereas the selling price for mixed paper has been indicated as ₹7–16/kg. The source of procurement with UBC included households (23%), streets (91%), waste bins (91%), and markets (100%). The UBC generation was reported from upper and middle income groups (27%), low income groups (36%), and commercial and business establishments (36%). The condition of procured UBC as reported by waste collectors included contained leftover juice in the packs (32%).

The concerns of the waste collectors regarding UBC were:
» Lack of awareness and markets of UBC
» Low rates of UBC offered

Waste collectors' response to the ways by which collection can be improved was markets at source

FIGURE 8 Waste collector interviewed during survey, Srinagar

collection can help. On the motivational front, waste collectors' response was that; awareness and a good market, good price, installation of separate factories for processing UBC so that its demand can grow in the market.

Small-Scale Dealer

Twelve small-scale dealers were surveyed spread across the city of Srinagar and these were dealing with residential, commercial, and institutional areas. The numbers of ragpickers/kabadis contributing these were around 5–25. The average mixed paper handled by these dealers was in the range 1,200 kg/month to 36,000 kg/month. Mixed paper purchase prices were indicated in the range of ₹5–12/kg and mixed paper selling prices were indicated in the range of ₹8–24/kg. About 67% small-scale dealers were collecting UBCs along with mixed waste paper which increased by 28% in comparison to previous study conducted in 2018, owing to higher prices offered for selling of mixed paper waste. The average UBC collected by each of these dealers varied from 5 kg/month to 112 kg/month. The source of procurement of UBC included households (21%), ragpickers (38%), door-to- door collector (21%), intermediate kabadis (21%), and malls and hotels (21%). The condition of the procured UBC was reported 36% contained leftover juice and 7% were in soiled condition. Upon asking the fate of UBC, the dealers mentioned that they sell it to other large-scale dealers and sell it along with mixed paper (14%), whereas 21% are rejects as these are not accepted by the dealers. Upon asking the fate of straws it was found that they are often the packs (7%), whereas in most cases they are not found with packs and is not collected (21%).

FIGURE 9 Small- scale dealer interviewed during survey in Srinagar

The challenges as highlighted by small-scale dealers in dealing with UBC separately were indicated as:

- Lack of buyer for UBC
- Lack of awareness amongst stakeholders that UBC is recyclable
- Lack of proper market for UBC collection and recycling
- No incentives for UBC collection

When asked how the collection of UBC can be improved, the dealers suggested the following:

- There should be a proper market established for UBC
- Good money should be provided for UBC collection
- UBC has to be incentivized at par with duplex paper

TABLE 7 Bale analysis of small-scale dealers conducted in Srinagar

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale scrap dealers	80.000	3.000	3.750
	90.000	0.500	0.556
	21.000	0.500	2.381
	55.000	0.100	0.182
	67.000	0.250	0.373
	60.000	0.320	0.533
	75.000	0.200	0.267
	45.480	0.090	0.198
	50.000	0.200	0.400
	50.550	0.020	0.040
	110.000	0.100	0.091
	100.000	0.880	0.880
Total	804.030	6.160	0.766

Large-Scale Dealer

Seven large-scale dealers were surveyed during the study, dealing in residential, commercial, and institutional areas. About 15–50 kabadis/ragpickers were contributing to these dealers. The average mixed paper turnover for a month ranged from 45,000 kg/month to 135,000 kg/month. The purchase price of mixed paper was indicated as ₹10–18/kg, whereas the selling prices were ₹12–25/kg. As there was no market/buyer for UBC, and no incentives were provided for its collection, only one of the large-scale dealers dealt in UBC. The purchase price of UBC was indicated as ₹4/kg whereas the selling price was indicated as₹5/kg. The source of procurement of UBC included households, ragpickers, door-to-door collectors, intermediate kabadis and other commercial areas such as hotels, shopping malls, markets, etc. The one dealing with the UBC reported the condition of UBC with packs containing leftover juice in it. Upon asking the fate of UBC, it was mentioned that it is sold along with the mixed paper. Some of the dealers also reported that the recyclers indicate difficulty in recycling UBCs owing to its multi-layer packaging, which discourages them to buy.

On asking the challenges for undertaking UBC recycling, the following points were indicated:

- Lack of buyers in the market
- Not accepted by dealers and factories for recycling owing to its multi-layer packaging
- Low incentives

The suggested improvements by large-scale dealers were as follows:

- Factories and dealers need to be involved by giving the good incentives
- Processing plant needs to be commissioned so that UBC becomes profitable for everyone
- Increased incentives
- Higher price should be offered at par with duplex paper

TABLE 8: Bale analysis of large-scale dealers conducted in Srinagar

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Large-scale scrap dealers	56	1	1.776
	75	0.2	0.267
	113.3	0.39	0.344
	101.7	0.025	0.025
	90.9	0.8	0.880
	47	0	0.000
	109.3	0.100	0.091
Total	594	3	0.424

Dumpsite Analysis

In Srinagar city, Achan dumpsite was selected for conducting the truckload sampling. Three trucks which came from commercial and residential areas were unloaded on the landfill site. This truck included the municipal waste in it from which mixed waste paper and UBC was segregated. Both mixed waste paper and UBC was weighed in the end.

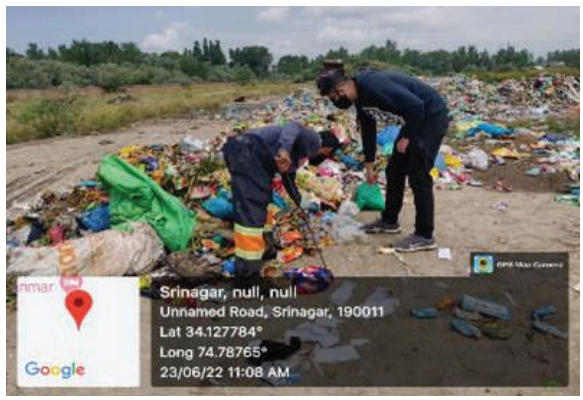


FIGURE 10 Dumpsite aAnalysis at Achan dumpsite, Srinagar

TABLE 9: The dumpsite analysis conducted in Srinagar

Truck	Truck load	Mixed paper waste	UBC found in paper waste
Truck 1	2455 kg	12.65 kg	8.37 kg
Truck 2	4680 kg	9.975 kg	7.975 kg
Truck 3	8010 kg	21.18 kg	9.975 kg

Guwahati

Around 22 waste collectors were interviewed during the survey including door-to-door waste collectors (28%) and ragpickers (73%) covering residential, commercial, and institutional areas spread across the city of Guwahati. The waste collectors deal with paper (86%), plastics (100%), metals (77%) as well as glass (22%). About 13% of waste collectors collected UBC, out of which 27% waste collectors were collecting UBC along with the mixed paper and 18% collected separately. Around 50% of the waste collectors were not engaged in the collection of UBC, out of which 50% does not collect due to lack of incentive, 40% due to lack of buyer or proper market and 4% as no one returns UBC to them. The average UBC collected by each of these waste collectors ranged from 13 kg/month to 100 kg/month. The average mixed paper was reported to be collected around 80 kg/month to 300 kg/month. The selling price of mixed paper and UBC has been indicated in the range of ₹10–20/kg and ₹2–12/kg, respectively. The source of procurement of mixed paper including UBC included household (23%), street (23%), waste bins (18%), markets (23%) and other commercial areas such as shopping malls, hotels, etc. (5%). The UBC generation was reported as from upper- and middle-income groups (22%), low-income groups (18%), and commercial and business establishments (18%). The condition of procured UBC was reported by waste collectors as soiled (22%), contained leftover juice (28%), and clean and ready for sale (10%). Upon asking the fate of UBC, it was reported that UBCs are sold along with the mixed paper. Upon asking the fate of straws, it was mentioned that they are often found with the packs and are sold along with the UBC only.

The major concerns of the waste collectors for dealing with UBC were:

» Limited number of buyers of UBC in the market

» Low rates offered for UBC collection with respect to duplex paper.

Waste collectors' response to the ways by which collection can be improved was markets at source collection can help. On the motivational front, waste generators' response was that; awareness and a good market, good price and more number of buyers in the market.

Small-Scale Dealers

Eleven small-scale dealers were surveyed across the city covering residential, commercial, and institutional areas. The number of ragpickers/kabadis contributing these were around 3–25. The average mixed waste paper handled by these dealers was around 3 kg/month to 23 kg/month. The mixed paper buying prices were in the range of ₹3–23/kg and selling price were indicated in the range of ₹10–30/kg. About 73% of the dealers collect UBC along with the mixed paper in comparison to 2018 where none of the dealers were engaged in the collection. The average UBC collected by each of the collector ranged from 0.45 kg/month to 15 kg/month. The purchasing price and selling price of UBC has been indicated as ₹2/kg and ₹308/kg, respectively. The source of procurement of UBC included households (21%), ragpickers (64%), door-to-door collectors (57%), intermediate kabadi (21%) and commercial areas such as hotels, malls, and markets (7%). When asked about the condition of the UBC collected, 7% of the respondents reported that it contains leftover juice and 7% mentioned that UBCs procured are often soiled. Upon asking the fate of UBC, dealers mentioned that 7% sell it further to larger dealers and 7% sell it to the recycler along with mixed paper. Upon asking the fate of straws, 7% mentioned that sometimes straws are found with the

FIGURE 11: Bale analysis conducted at small-scale dealer in Guwahati

packs and only 7% responded that normally UBCs are not found with pack and are not collected.

The challenges as highlighted by small scale dealers in dealing with UBC separately were indicated as:

» Lack of buyers in the market
» Lack of awareness
» Lack of proper market for recycling
» Less price is offered for the collected UBC

The suggested improvements by small-scale dealers were as follows:

» There should be a proper market established for UBC collection and recycling
» A reasonable price should be offered

Large-Scale Dealer

Four large-scale dealers were surveyed during the study, covering residential, commercial, market, and institutional areas. About 7–20 kabadis/ragpickers were contributing to these dealers. The average mixed paper turnover ranged from 800 kg/month to 1500 kg/month. Around 50% of large-scale dealers reported collecting UBC along with the mixed paper. The average UBC collected by each of these dealers varied from 0.6 kg/month to 5 kg/month. The purchase price of mixed paper was indicated in the range of ₹6–

TABLE 10: Bale analysis of small-scale dealers conducted in Guwahati

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Small-scale dealers	300	1	0.333
	300	3	1.000
	400	5	1.250
	90	0.45	0.500
	400	2	0.500
	400	2.5	0.625
	300	1	0.333
	400	5	1.250
	400	3	0.750
	150	6	4.000
	400	1	0.270
Total	**3540**	**30.03**	**0.848**

FIGURE 12: Bale analysis conducted at large scale dealer in Guwahati

20/kg and the selling price as ₹5–30/kg. The source of procurement of UBC included household (43%) and door- to-door collectors (43%). The dealers dealing with the UBC reported the condition of procured UBC as clean and ready for sale. Upon asking the fate of

UBC, the dealers mentioned that they sell it along with mixed paper.

The major challenges as highlighted by large-scale dealers in dealing with UBC collection and recycling were indicated as:

» Low price provided for UBC
» Lack of buyers and market for UBC
» Lack of awareness

The suggested improvements by large-scale dealers were as follows:

» Proper market for UBC recycling
» High price should be offered at par with duplex paper

Table 11: Bale analysis of large-scale dealer conducted in Guwahati

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Large-scale dealers	200	0	0.000
	407	5	1.229
	421	3	0.713
	200	0.6	0.300
Total	1228	8.6	0.700

Dumpsite Analysis

The dumpsite analysis was conducted at Boragaon in Guwahati. Three trucks were unloaded at the dumpsite covering residential, commercial, and institutional areas from different parts of the city. The mixed paper and UBC were segregated and were weighed in the end.

FIGURE 13 Dumpsite analysis at Boragaon, Guwahati

TABLE 12: The dumpsite analysis conducted in Guwahati

Truck	Truck load	Total mixed paper waste	UBC in dry waste
Truck 1	3872 kg	2364 kg	6 kg
Truck 2	5983 kg	3695 kg	10.9 kg
Truck 3	6549 kg	4491 kg	14 kg

Jammu

Waste Collector

About 22 waste collectors were interviewed during the study including ragpickers (100%) covering residential, commercial, and institutional areas. The collectors deal with plastics (100%), papers (100%), glass (82%), metal (100%), cardboard (100%), and Styrofoam (9%). Around 9% of the waste collectors collect UBC, out of which about 16% collected UBC separately while 12% collect it along with mixed with paper/cardboard. The reason why UBC was not collected, 90% said there were no incentives received on UBC collection and 86% said there were no buyer and developed market. The average UBC collected by each of the waste collectors varied from 20 kg/month to 40 kg/month. The average mixed paper collected by each of these collectors varied from 250 kg/month to 1500 kg/month. The selling price of UBC has been indicated as ₹4/kg, whereas selling price of mixed paper has been

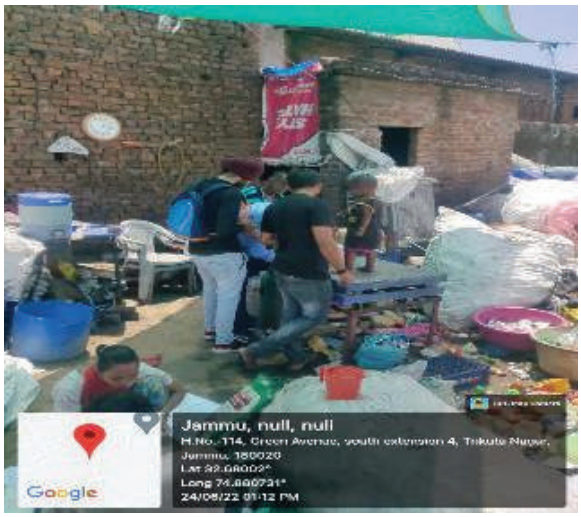


FIGURE 14: Waste collector interviewed during survey in Jammu

indicated as ₹10–15/kg. The source of procurement of mixed paper included streets by 100%, waste bins by 100%, markets by 100% and other commercial areas such as hotels, malls by 68%. The UBC generation was reported from upper- and middle-income localities (9%), lower income localities (9%), and commercial and business establishments (4%).

The waste collectors reported the condition of procured UBC packs reaching them with 9% already containing juice in it and sold to the dealer as mixed waste.

The major concerns as highlighted by waste collectors for not collecting UBC separately were as follows:

- No buyers and market due to polyal layer
- No money provided on UBC segregation and collection
- Insufficient time for collection
- Lack of market

Waste collector's response to the ways by which collection can be improved was through establishing a proper market to sell the collected UBC. On the motivational front, waste collector's response was that; a good price and incentive can encourage collection of UBC. This would require a proper system to be in place for waste collection.

Small-Scale Dealer

About 14 small-scale dealers were interviewed in different areas of Jammu covering residential, commercial, and institutional areas. About 8–24 ragpickers/kabadis were contributing to these dealers. The average mixed paper handled by each of these dealers was in the range of 1000 kg/month to 50,000 kg/month. Around 36% of the small-scale dealers were collecting UBC, all of which collected UBC along with mixed waste. The average UBC collected by each of these dealers varied from 2 kg/month to 500 kg/month. The rest 50% do not collect UBC due to no incentive, buyers, and market. Mixed paper purchase price was indicated in the range of ₹7–17/kg and mixed paper selling prices were indicated in the range of ₹12–20/kg. The purchase price of UBC has been indicated as ₹3–8/kg whereas the selling price of UBCs to larger dealers was ₹5–10/kg. The source of procurement of UBC included household (86%), rag picker (93%), door-to-door collector (71%), intermediate kabadi (7%) and commercial areas such as hotels, shopping malls, markets, etc. (7%). The condition of procured UBC were reported as 35% containing leftover juice and 21% being soiled. Upon asking the fate of UBC, the dealers mentioned that about 28% sell it to large dealers, 7% to the recyclers, and 14% sell it along with mix paper.

FIGURE 15: Small scale dealer interviewed in Jammu during survey

The challenges as highlighted by small-scale dealers in dealing with UBC collection separately were indicated as:

» Due to its multi-layer packaging, factories do not accept UBC
» Lack of incentive
» Lack of proper market and buyers

The suggested improvements by small-scale dealers were as follows:

» Establishing a developed market value chain for collection and recycling of UBC
» Increased awareness on collection and segregation
» Good incentives to be provided for UBC collection and segregation
» Higher price should be offered at par with that of duplex paper/cardboard

TABLE 13: Bale analysis of small-scale dealers conducted in Jammu

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale dealers	51.15	0.2	0.391
	79	0	0.000
	108	0.3	0.278
	19.1	0	0.000
	43	0	0.000
	8.3	0.1	1.205
	73.9	0	0.000
	37.6	0.6	1.596
	33.4	1.15	3.443
	34	0	0.000
	79	0	0.000
	40.3	0	0.000
	70	0	0.000
	8.3	1	12.048
Total	685.050	3.350	0.489

Large-Scale Dealer

About 7 large-scale scrap dealers were interviewed during the study, covering residential, commercial, and institutional areas. Around 15–40 kabadiwalas/ragpickers were contributing to these dealers. The average mixed paper turnover ranged from 55,000 kg/month to 5,000,000 kg/month. Around 14% of the dealers were collecting UBC along with mixed waste and 57% did not collect UBC as there is no market for selling UBC. The average UBC collected by each of these dealers were around 200 kg/month. The purchase price of UBC was indicated in the range of ₹4/kg and selling price was about ₹6/kg whereas purchase price of mixed paper was indicated in the range of ₹6–12/kg and a selling price from ₹16–40/kg. The source of procurement of UBC was from intermediate kabadis (14%), household (14%), door-to-door collector (14%), and others like shops, markets (14%). The condition of procured UBCs was reported as 14% contained leftover juice in the packs and 14% were being soiled. Upon asking the fate of UBC, stakeholders mentioned that they sell the UBC along with mixed paper to the recyclers.

The challenges as highlighted by large-scale dealers in dealing with the collection and recycling of UBC were indicated as:

» Lack of market value

FIGURE 16: Bale analysis conducted at large-scale dealers in Jammu

» Lack of incentive
» Lack of buyers
» Unavailability of market
» Absence of market chain

The suggested improvements by large-scale dealers were as follows:

» Higher price should be offered at par with duplex paper
» Better incentives should be there for collection
» There should be proper market

TABLE 14: Bale analysis of large-scale dealers conducted in Jammu

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Large-scale dealers	79	0	0.000
	147	0.2	0.136
	73.9	2	2.706
	81	0	0.000
	155.7	0.06	0.039
	125.45	0.3	0.239
	96	0.000	0.000
Total	758.050	2.560	0.302

Dumpsite Analysis

At the dumpsite in Jammu, three trucks were unloaded at the site covering residential, commercial and institutional areas from different parts of the city. These trucks included the municipal waste in it from which mixed waste paper and UBC was segregated. Both mixed waste paper and UBC was weighed in the end.

At the dumpsite, it was observed that the ragpickers sometimes pick up the large UBC but not the small ones. When asked they said that the larger UBCs are heavier and hence they are still profitable and at

FIGURE 17: Dumpsite analysis in Jammu

times, the large-scale dealers do not deduct money if little UBC is found within the sold mixed paper load.

TABLE 15: The dumpsite analysis conducted in Jammu

Truck	Truck load	Mixed paper waste	UBC found in paper waste
Truck 1	6000 kg	8.8 kg	7.9 kg
Truck 2	6000 kg	7.5 kg	2.26 kg
Truck 3	7000 kg	22 kg	5.855 kg

Faridabad

Waste Collectors

About 21 waste collectors were surveyed in Faridabad, which included both ragpickers and door-to-door waste collectors covering residential, institutional, and commercial areas. The waste collectors collect all type of dry waste including plastics (95%), papers (95%), glass (81%), metal (90%), cardboard (86%), and styrofoam (81%). About 19% of waste collectors were collecting UBC, out of which 71% collect UBC along with mixed paper whereas 43% reject UBC. Several waste collectors also mentioned that there is a shortage of buyers for the collected UBC (62%), hence they avoid collecting UBC. However, there is an increase in the dealers involved in the collection

FIGURE 18: Waste collector interviewed during survey in Faridabad

of UBC along with the mixed paper owing to higher prices offered for mixed paper. The average UBC collected by each of the collectors ranged from 10 kg/month to 500 kg/month. The average mixed paper was reported to be collected around 4 kg/month–3,000,000 kg/month. The selling price of UBC has been indicated as ₹6–10/kg whereas price of mixed paper varied from ₹8–22/kg. The source of procurement of mixed waste including UBC included households by 57%, street by 52%, waste bins by 33%, and markets by 33%. UBC generation was reported from upper and middle income localities (42%), lower income localities (19%), and commercial or business establishments (52%). The condition of UBC as reported by the waste collectors was mostly soiled (10%) and clean and ready for sale (76%). The major concerns of the waste collectors for not collecting UBC separately was that there are very few buyers of UBC and no incentives are provided for UBC segregation and collection. The collection and recycling of UBC may improve through awareness and a proper market along with good price for collection and segregation is provided.

Small-Scale Waste Dealers

Fourteen small-scale dealers were surveyed across the city covering residential, commercial, and institutional areas. A large number of small-scale dealers and ragpickers (about 3–600) were supplying materials to each of these waste dealers. The average mixed paper handled by these dealers varied from 7000 kg/month to 1,000,000 kg/month. Mixed paper purchase price was indicated in the range of ₹3–22/kg and selling prices were indicated in the range of ₹9–28/kg. Seventy-one per cent of stakeholders were collecting UBC along with mixed paper. The average UBC collected by each of these dealers varied from 1200 kg/month to 4000 kg/month. The purchase price of UBCs were indicated in the range of ₹3–7/kg whereas the selling prices were indicated in the range of ₹8–12/kg which is higher in comparison to 2018 study. The source of procurement of UBCs included households (30%), ragpickers (38%), door-to-door collectors (23%), intermediate kabadis (38%) and others including hotels, shopping malls, markets and dustbin (69%). The dealers dealing with UBC, reported condition of UBC as 38% containing leftover juice and 30% are clean and ready for sale. Upon asking the fate of UBCs, the dealers mentioned that about 53% of the dealers sell it to large-scale dealers and 15% sell it along with mix paper.

The challenges as highlighted by small-scale dealers for not dealing with UBC collection were indicated as:

- Lack of incentive for UBC collection
- Lack of proper market and buyers
- Low value and lesser in quantity
- Lack of storage space
- Lack of awareness on UBC collection and segregation

The suggested improvements by small-scale dealers were as follows:

- Establishing of proper market
- Increased awareness on collection and segregation
- Higher price should be offered at par with duplex paper

FIGURE 19: Small-scale dealer interviewed during survey in Faridabad

TABLE 16: Bale Analysis of small-scale dealers conducted in Faridabad

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC(%)
Small-scale dealers	332	1.35	0.407
	255	0.8	0.314
	203	0.96	0.473
	300	1.2	0.400
	241	3.8	1.577
	272	4.75	1.746
	458	4.9	1.070
	500	1.2	0.240
	400	1	0.250
	385	0.75	0.195
	127	0.65	0.512
	108	2.9	2.685
	198	1.1	0.556
	100	1	1.000
Total	3879.00	26.360	0.680

Large-Scale Dealer

Seven large-scale scrap dealers were interviewed covering residential, commercial, and institutional areas. About 10–80 ragpickers/kabadis were contributing to these dealers. The average mixed paper turnover ranged from 60,000 kg/month–215,000 kg/month. About 86% large-scale dealers reported of collecting UBC along with mixed paper. The average UBC collected by each of these dealers varied from 100 kg/month to 700 kg/month. The selling price of UBC was reported as ₹6 /kg. The purchase price of mixed paper was indicated in the range of ₹2.5–18/kg and selling price was indicated in the range of ₹3–25/kg. The source of procurement of UBC included households (44%), rag picker (22%), intermediate kabadis (11%) and others including hotel, airport, malls, dustbins, and factories (44%). The ones dealing with UBC reported its condition with about 22% containing leftover juice and 33% mentioned that UBCs procured are clean and ready for sale. Upon asking the fate of UBC, 55% reported that UBC are sold further to other larger dealers.

The major challenges as highlighted by large-scale dealers in dealing with the UBC collection and recycling were indicated as:

- Lack of awareness
- Low price

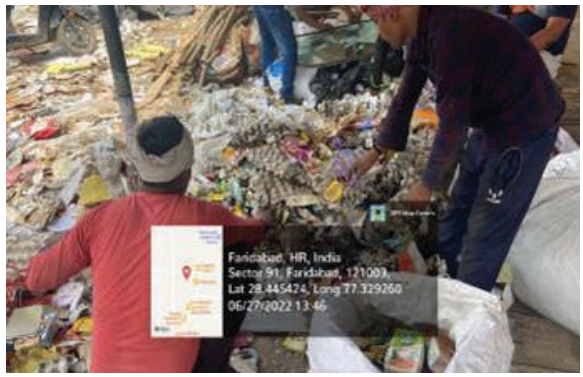


FIGURE 20: Bale analysis conducted at a large-scale dealer, Faridabad

» Additional labour cost incurred
» Lack of storage space
» Lack of buyers in the market

The suggested improvements by large-scale dealers were as follows:

» Increased awareness
» Improved market value
» Better infrastructure
» Better price
» Proper market

TABLE 17: Bale analysis of large-scale dealers conducted in Faridabad

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Large-scale dealers	443	10	2.257
	340	6.25	1.838
	315	7	2.222
	197	3	1.523
	155	1.2	0.774
	108	2.9	2.685
	136.2	10	7.342
Total	1694.200	40.350	2.382

Dumpsite Analysis

The dumpsite analysis was conducted at the Mujheri dumping yard in Faridabad. Three trucks were unloaded at the dumpsite with waste containing from the residential, commercial, and institutional areas of Faridabad. The trucks contained municipal waste from which the mixed paper and UBC were segregated.

TABLE 18: The dumpsite analysis conducted in Faridabad

Truck	Total Truck Load	Mixed Paper Waste (kg)	UBC found (kg)
Truck 1	200	95	0.3
Truck 2	343	125	0.5
Truck 3	445	145	0.5

FIGURE 21: Dumpsite analysis at Mujheri Dumping Yard, Faridabad

Dharamshala

Waste Collector

About 22 waste collectors were interviewed across the city, including 14 ragpickers and 8 door-to-door collectors covering residential, commercial, and institutional areas. All the collectors deal with paper, plastic, glass, metal, cardboard and multi-layer packaging. About 36% of the waste collectors were collecting UBC along with mixed paper for the purpose of recycling. The remaining are not engaged in the collection of UBC due to lack of buyers in the market. The average UBC collected by each of these dealers varied from 8 kg/month to 20 kg/month. The average mixed paper collected is around 20 kg/month to 60 kg/month with selling price indicated as ₹10–14 per kg. The source of procurement of mixed paper along with UBC included households (45%), streets (23%), waste bins (45%), and markets (45%). The source of major UBC generation was reported from upper and middle income groups (27%), low income groups (23%), and commercial and business establishments (27%). The conditions of UBCs were reported as soiled (5%), does not contain leftover juice (36%), and clean and ready for sale (5%).

FIGURE 22: Waste collector interviewed during survey in Dharamshala

The concerns as highlighted by the waste collectors in dealing with UBC collection separately were indicated as:

- Lack of buyers in market
- Lack of market value for UBC
- Lack of incentives

Waste collectors' response to the ways by which collection can be improved was good incentive with good market price along with awareness can help.

Small-Scale Dealer

12 small-scale dealers were surveyed across the city, covering with residential, commercial, and institutional areas. Around 2–12 ragpickers/kabadis were contributing to these dealers. The average mixed paper handled by each of these dealers varied from 200 kg/month to 14,000 kg/month. Out of these, only one small-scale dealer was accepting UBC with mixed paper. The average quantity of UBC collected was in the range of 200 kg/month to 300 kg/month. The purchase price of mixed paper was in the range of ₹10–14/kg and the selling price was in the range of ₹10–20/kg. The source of procurement of mixed paper were reported as households, ragpickers and commercial establishments such as hotels, shopping malls, etc. The conditions of procured UBCs were reported as 8% soiled, and 7% having leftover juice. Upon asking the fate of UBC, it was reported that the dealers sell it to large-scale dealers or to recyclers along with mixed paper.

The major challenges as highlighted by small-scale dealers in dealing with UBC were indicated as:

- No incentives for UBC collection
- UBCs contain leftover juice because of which the facility becomes prone to pest and rodent attacks

The suggested improvements by small-scale dealers were as follows:

- Good money for UBC
- More money and incentives
- More buyers in market for UBC
- More awareness about UBC in value chain

FIGURE 23: Small-scale dealer interviewed during survey in Dharamshala

TABLE 19: Bale analysis of small-scale dealers conducted in Dharamshala

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale scrap dealers	61	0	0.000
	50.5	0	0.000
	53	0	0.000
	92.8	2.4	2.586
	75.2	0	0.000
	55.25	0	0.000
	66.15	0	0.000
	60.35	0	0.000
	48.75	0	0.000
	51.05	0	0.000
	49.85	0	0.000
	70.1	0	0.000
Total	734	2.4	0.327

Large-Scale Dealer

Five large-scale dealers were interviewed across the city covering residential, commercial, and institutional areas. About 15–50 small-scale dealers and ragpickers were contributing to these dealers. The average mixed paper turnover ranged from 15,000 kg/month to 40,000 kg/month. Only one large-scale dealer reported collecting UBC, with mixed paper. Average UBC collected by the dealer was 500 kg/month. The purchase price of mixed paper was indicated in the range of ₹10–25/kg and the selling price of paper was indicated in the range of ₹10–30/kg. Owing to the low value, UBCs are not purchased and sold in the market. The source of procurement of UBCs included households (40%), ragpickers (100%), intermediate kabadis (80%), door-to- door collectors (80%) and others (100%) including hotel, airport, malls, dustbins, and factories. The conditions of UBCs were reported as sometimes soiled (20%), contain leftover juice (20%), 80% were clean and ready for sale. When stakeholders were asked about the processing of UBC they mentioned they make bales of them and sell it. Large-scale dealers explained that they sell it to paper mills further down the line.

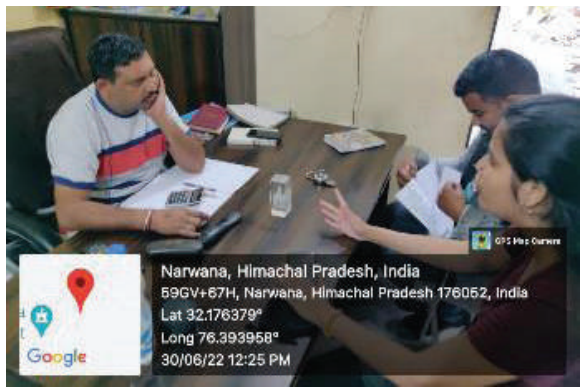


FIGURE 24: Large-scale dealer interviewed during survey in Dharamshala

The major challenges as highlighted by large-scale dealers in dealing with the collection and recycling of UBC were indicated as:

» Lack of developed markets

» Low price of UBC

The suggested improvements by large-scale dealers were as follows:

» Improved market value

» Higher price similar to that of duplex paper

» More buyers in the market

TABLE 20: Bale analysis of large-scale dealers conducted in Dharamshala

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Large-scale scrap dealers	193.8	11	5.676
	53	0	0.000
	98.2	0	0.000
	101.54	0	0.000
	68	0	0.000
Total	514.54	11	2.138

Dumpsite Analysis

At the dumpsite in Dharamshala, three trucks from commercial and residential areas were unloaded on the landfill site. These trucks included municipal solid waste in it from which mixed waste paper and UBC was segregated. Both mixed waste paper and UBC was weighed in the end. The dumpsite also has a private kabadiwala residing within the premises, who purchases all recyclables from the waste drivers after segregation. He purchases at a lower rate than the other kabadiwallahs in the city.

FIGURE 25: Dumpsite analysis, Dharamshala

TABLE 21: The dumpsite analysis conducted in Dharamshala

Truck	Total truck load (kg)	Mixed paper waste (kg)	UBC found (kg)
Truck 1	300	19.7	9.75
Truck 2	300	9.9	5.64
Truck 3	300	6.95	6.5

Shimla

Waste Collector

Twenty-two waste collectors were surveyed across the city which included both ragpickers (95%) and door-to-door waste collectors (5%) covering residential, commercial and institutional areas. The waste collectors collect all types of dry waste including paper, plastic, glass, metal, cardboard, and Styrofoam. Unlike the previous study conducted in 2018, all of the waste collectors did not engage in collection of UBC as there are no buyers/ market and no incentives are provided. The average mixed paper was reported to be collected around 240 kg/month to 1150 kg/month. The selling price of mixed paper has been indicated in the range of ₹10–14/kg. The source of procurement of mixed paper included households (14%), streets (86%), waste bins (95%), and markets (86%).

The major concerns as highlighted by waste collectors in dealing with UBC were as follows:

- Less resale values
- Low quantity of UBC
- Shortage of time for segregation
- Lack of buyers in the market

Waste collectors' response to the ways by which collection can be improved was through offering price at par with that of duplex paper. On the motivational front, waste collectors' response was that; increased awareness, good market, and segregation of UBC at source can also improve collection and recycling of UBC.

Small-Scale Dealers

Fifteen small-scale dealers were surveyed across the city covering residential (93%), commercial (93%), and institutional areas (14%). Around 10–30 kabadis/ ragpickers contribute to these dealers. The average mixed paper handled by these dealers varied from 5000 kg/month to 12,000 kg/month. The purchase price of mixed paper has been indicated in the range of ₹5–20/kg and selling price has been indicated in the range of ₹12–30/kg. None of the small-scale dealers collected UBC, since there was no particular dealer within the vicinity of Shimla who purchased UBC. The large-scale dealers who were accepting UBC were majorly located in cities like Solan and Hamirpur, which were about 50–100 km from Shimla city.

FIGURE 26: Small-scale dealer interviewed during survey, Shimla

The challenges as highlighted by small-scale dealers in dealing with UBC were indicated as:

» Lack of knowledge and awareness

» Low value for UBC collected

» High labour cost and time consumption

» Small quantities of UBC

» Lesser price

The suggested improvements by small-scale dealers were as follows:

» Better infrastructure

» Good money

» Segregation at source level

» Establishing of proper market

Large-Scale Dealer

Five large-scale dealers were surveyed across Shimla (outskirts), Solan and Hamirpur covering residential, commercial, and institutional areas. About 15–50 kabadis/ragpickers contributed to these dealers. The average mixed paper turnover ranged from 90,000 kg/month to 150,000. The purchase price of mixed paper was indicated as ₹8–15/kg and selling price as ₹15–18/kg. All the large-scale dealers collected UBCs and accepted it with mixed waste paper. The average UBC collected by each of these large-scale dealers varied from 10 kg/month to 15 kg/month.

TABLE 22: Bale analysis of small-scale dealers conducted in Shimla

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small scale scrap dealers	17.20	0	0.000
	30.00	0	0.000
	19.00	0	0.000
	15.90	0	0.000
	16.00	0	0.000
	20.00	0	0.000
	24.96	0	0.000
	23.90	0.1	0.418
	20.95	0	0.000
	22.15	0	0.000
	33.50	0	0.000
	45.25	0	0.000
	21.85	0	0.000
	19.90	0	0.000
	22.20	0	0.000
Total	371.61	0.1	0.027

The source of procurement of UBC included household (100%), ragpickers (100%), door-to-door collector (100%), intermediate kabadi (100%), and other commercial areas such as hotels, shopping malls, markets, etc. (20%). The ones dealing with UBC reported mostly that the pack was soiled, but sometimes it was clean and ready for sale. None of the dealers were processing UBCs before selling. Upon asking the fate of UBC, 100% reported that it is sold further to other large-scale dealers along with mixed paper.

The challenges as highlighted by large-scale dealers in dealing with the collection and recycling of UBC were indicated as:

» Lack of buyers in the market

» High labour cost and time consumption

The suggested improvements by large-scale dealers were as follows:

» Establishing a proper market

» Price offered should be at par with duplex paper

» Improved market value

TABLE 23: Bale analysis of large-scale dealers conducted in Shimla

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Large-scale scrap dealers	300	7.2	2.400
	114	3.35	2.939
	200	5	2.500
	152	2.5	1.645
	149	3	2.013
Total	915	21.05	2.301

Dumpsite Analysis

The dumpsite analysis in Shimla took place at the Elephant Waste-to-Energy (WtE) plant. Three trucks came from commercial and residential areas were unloaded on the landfill site. These trucks included municipal solid waste in it from which mixed paper and UBC was segregated. Both mixed waste paper and UBC was weighed in the end.

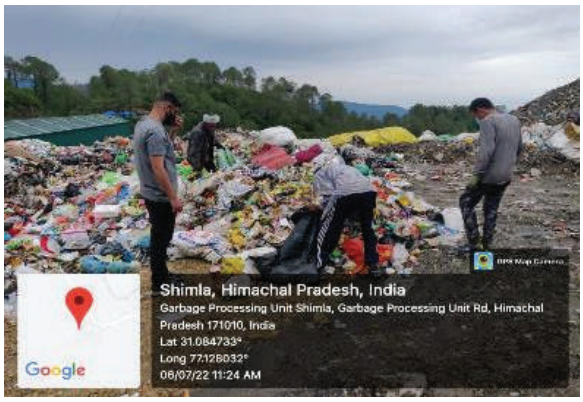


FIGURE 27: Dumpsite analysis, Shimla

TABLE 24: The dumpsite analysis conducted in Shimla

Truck	Total truck load	Mixed paper waste	UBC found
Truck 1	640 kg	11 kg	1.5 kg
Truck 2	730 kg	3.5 kg	1 kg
Truck 3	860 kg	11 kg	1.5 kg

Kolkata

Waste Collectors

Twenty-two waste collectors were interviewed during the study including 19 ragpickers and 3 door-to-door waste collectors covering residential, commercial, and institutional areas. The collectors deal with paper (68%), plastic (95%), glass (73%), metal (86%), and cardboard (82%). Around 14% of the waste collectors were collecting UBC out of which 68% were collected along with mixed paper whereas 5% collected separately, while the remaining did not collect UBC due to lack of buyers in market (50%), lack of money/incentives (23%), and availability of the UBC in low quantities (9%).

The average UBC collected by each of these collectors ranged from 1 kg/month to 25 kg/month. The average mixed paper was reported to be collected around 50 kg/month to 60 kg/month. The selling of UBC has

FIGURE 28: Waste collector interviewed during survey in Kolkata

been indicated in the range of ₹2–3 /kg whereas the selling price of mixed price as ₹2–7 /kg. The source of procurement of mixed paper including UBC included households (53%), streets (6%), waste bins (18%), markets (18%) and other commercial areas such as malls, hotels, etc. (6%). The UBC generation was reported from upper- and middle-income localities (36%), lower income localities (9%) and commercial or business establishments (41%). The condition of the UBC reaching to these waste collectors were reported as soiled (40%), not containing any leftover juice (14%), and clean and ready for sale (27%).

The major concerns for not collecting UBC were that there are no buyers of UBC in the market and no incentives are provided for UBC segregation and collection. The collection and recycling of UBC may improve through offering a good price and incentives which would help in establishing proper market for UBC and motivate various stakeholders to get them collected for recycling.

Small-Scale Waste Dealers

Fourteen small-scale dealers were interviewed across the city covering residential, commercial, and institutional areas. Around 10–25 kabadis/ragpickers were contributing to these dealers. The average mixed waste paper collected by each of these dealers varied from 200 kg/month to 400 kg /month. About 85% of the small-scale dealers were collecting UBC along with mixed paper which increased tremendously in comparison to the previous study conducted in 2018. The purchase price of the UBC has been indicated in the range of ₹2–3 /kg, whereas for the mixed paper it was from ₹2–7/kg. The selling price for mixed paper has been indicated in the range of ₹8–12/kg whereas for UBC it is from ₹2–3 /kg. The source of procurement of the UBC included households (36%), ragpickers (43%), door-to-door collector (14%), intermediate kabadis (7%), and other commercial areas such as shopping malls, hotels, etc. (7%). Of the procured UBCs, 31% were in soiled condition, 23% contained leftover juice

FIGURE 29: Bale analysis conducted at small-scale dealer, Kolkata

and about 15% were in a clean condition ready for sale. Upon asking the fate of UBC, 64% sell it to other large-scale dealers and 71% to the recyclers.

The major concerns as highlighted by small-scale dealers in dealing with UBC were indicated as:

- Lack of resale value
- Multi- layer packaging
- Lack of buyers in the market

The suggested improvements by small-scale dealers were as follows:

- Needs to accepted by large-scale dealers
- Proper market for collection and recycling
- Increased Awareness

Large-Scale Dealer

About 7 large-scale waste dealers were interviewed covering residential, commercial, and institutional areas. A large number of small-scale waste dealers and waste collectors contribute to these dealers. All the dealers were collecting UBC along with the mixed paper. The average UBC collected by each of these dealers ranged from 100 kg/month to 400 kg/month. The purchase price of mixed paper has been indicated in the range of ₹2–6 /kg whereas the selling price for mixed paper is ₹6–10/kg. The purchase price of UBC was

TABLE 25: Bale analysis of small-scale dealers conducted in Kolkata

Category	Weight of bale analysed (kg)	UBC found (kg)	Percentage of UBC (%)
Small-scale Dealers	320	2.11	0.659
	430	2.5	0.581
	100	2	2.000
	33.6	0.997	2.967
	44.6	0	0.000
	36.6	0.89	2.432
	27.8	1.23	4.424
	320	0.79	0.247
	100	2	2.000
	120	1.5	1.250
	100	1	1.000
	100	0.9	0.900
	50	1.5	3.000
	80	0.6	0.750
Total	1862.6	18.017	0.967

reported to have no value with a selling price for UBC in the range of ₹2–3/kg. The source of procurement of UBC included households (71%), ragpickers (43%), door-to-door collectors (57%), and other commercial areas such as shopping malls, hotels, etc. (43%). The condition of the procured UBC was reported as soiled (75%), contained leftover juice (25%). Upon asking the fate of UBC it was reported that 57% sell it to other large-scale dealers along with mixed paper whereas 43% sell it to recyclers.

The challenges as highlighted by large-scale dealers in dealing with the collection and recycling of UBC were indicated as:

» Low selling price
» Lack of buyers
» Lack of market for UBC

FIGURE 30: Bale analysis conducted at large-scale dealer in Kolkata

» The suggested improvements by large-scale dealers were as follows:
» Establishing of a proper market
» Better price
» Needs to be accepted by large-scale dealers and recyclers

TABLE 26: Bale analysis of large-scale dealers conducted in Kolkata

Category	Weight of bale analysed (kg)	UBC found (kg)	% of UBC
Large-Scale Dealers	186	1.03	0.554
	100	0.3	0.300
	261	1.38	0.529
	380	2.25	0.592
	300	5	1.667
	450	3	0.667
	400	3	0.750
Total	2077	15.66	0.754

Dumpsite Analysis

Dumpsite analysis was done at Pramod Nagar dumping ground. Three trucks were unloaded at the dumpsite with waste containing from residential, institutional, and commercial areas. The trucks included municipal

FIGURE 31: Dumpsite analysis at Pramod Nagar Dumping Yard, Kolkata

solid waste from which the mixed paper and UBC was segregated which were weighed in the end.

TABLE 27: The dumpsite analysis conducted in Kolkata

Truck	Total Truck Load (kg)	Mixed Paper Waste (kg)	UBC found (kg)
Truck 1	1580	94	1.48
Truck 2	2380	150	2.5
Truck 3	1690	180	1.64

Bhubaneswar

Waste Collectors

About 19 waste collectors were surveyed across the city, which included ragpickers covering residential, institutional, and commercial areas to these collectors. All the surveyed collectors were dealing in plastics (100%), papers (100%), glass (95%), and cardboard (100%). None of them were collecting UBC for recycling due to lack of incentive and lack of buyers in the market. The average mixed paper was reported to be collected around 60 kg/month to 180 kg/ month. The selling price of mixed paper varied from ₹5–10/kg. The source of procurement of mixed paper included streets (100%), waste bins (100%), markets (100%), and other commercial areas (16%). UBC generation

FIGURE 32: Waste collector interviewed during survey in Bhubaneswar

was reported from upper and middle class localities (16%), lower income localities (79%), and commercial or business establishments (79%).

The major concerns for not collecting UBCs separately were indicated as:

- Low cost
- Lack of buyers and market
- Lack of incentives

The collection and recycling of UBC may improve through establishing a proper market for collection and recycling with good incentives and higher prices offered for collection.

Small-Scale Dealers

About 14 small-scale dealers were interviewed across the city covering residential, commercial, and institutional areas. Around 10–105 ragpickers/kabadis contribute to these dealers. The average mixed paper handled by the dealers varied from 12 kg/month to 7000 kg/month. Similar to the study conducted in 2018, none of the dealers were collecting UBC due to lack of buyer in the market. The purchase price of mixed paper has been indicated in the range of ₹ 10–15/kg and the selling price in the range of ₹10–16/kg. The source of procurement of UBC included household,

FIGURE 33: Bale analysis conducted at small-scale dealer in Bhubaneswar

street, and waste bins. Upon asking the fate of UBC, all the dealers mentioned of selling the UBC hidden along with mixed paper to large-scale dealers.

On asking the challenges faced for undertaking UBC recycling the following points were indicated:

» Lack of buyers in market

» Lack of incentives for collection

The suggested improvements by small-scale dealers were as follows:

» Establishing of a proper market for collection and recycling

» High price should be offered at par with that of duplex paper

» Increased awareness on collection and segregation

Large-Scale Dealer

About 7 large-scale scrap dealers were interviewed across the city covering residential, commercial, and institutional areas. Around 20–35 ragpickers/kabadis contribute to these dealers. The average mixed paper turnover ranged from 2,000 kg/month to 17,000 kg/month. None of the large-scale dealers purchased UBC, however, a few of them stated that they receive UBC along with mixed paper waste. None of them dealt with UBC in Bhubaneswar city and the UBC

TABLE 28: Bale analysis of small-scale dealers conducted in Bhubaneswar

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale dealers	30	0	0.000
	35	0	0.000
	30	0	0.000
	32	0	0.000
	34	0	0.000
	41	0	0.000
	36	0	0.000
	30	0	0.000
	35	0	0.000
	30	0	0.000
	36	0	0.000
	30	0	0.000
	35	0	0.000
	40	0	0.000
Total	**474**	**0**	**0.000**

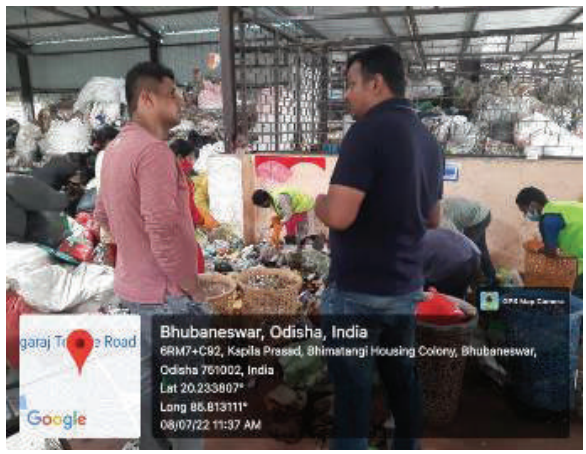


FIGURE 34: Large-scale dealer interviewed in Bhubaneswar

that comes to their facility accidentally is sold along with mixed paper waste. The average UBC collected by each of these dealers varied from 10 kg/month to 150 kg/month. The purchase price of mixed paper was indicated in range of ₹2–15/kg and selling price from ₹3–20/kg. The source of procurement of UBC included households (71%), street (57%), waste bins (57%), markets (43%) and other commercial areas such as shopping malls, hotels, etc. (29%). The condition of the procured UBC as reported by the large-scale dealers were mostly soiled (86%) and contained leftover juice (71%). Upon asking the fate of UBC, all the large-scale dealers reported that they sell it to other large-scale dealers or recyclers along with the mixed paper.

The challenges as highlighted by large-scale dealers in dealing with UBC were indicated as:

» Lack of buyers in market
» Low selling prices
» Lack of awareness

The suggested improvements by large-scale dealers were as follows:

» Establishing a proper market for UBC collection and recycling
» Improved market value
» Increased awareness
» More buyers in market for UBC

Dumpsite

The dumpsite analysis was done at Sainik School, VSS Nagar in Bhubaneswar. Three trucks were unloaded at site covering commercial, residential, and institutional areas. These trucks included municipal solid waste from which mixed paper and UBC were segregated and weighed in the end.

Chandigarh

Waste Collectors

About 22 waste collectors were interviewed across the city including ragpickers (14%) and door-to-door waste collectors (86%) covering residential, commercial, and institutional areas. The collectors deal with paper (100%), plastics (100%), glass (100%), metal (100%), and cardboard (100%). None of the waste collectors were collecting UBC due to lack of incentive (50%) and lack of buyers in the market (91%). The average mixed paper collected by each of these collectors varied from 90 kg/month to 900 kg/month. The selling price of mixed paper has been indicated in the range of ₹3–5/kg. The source of procurement of mixed paper including UBC included households (91%), street (5%), waste bins (64%), and market (73%). The UBC generation was reported from lower income localities (32%). The condition of procured UBC by the waste collectors were reported as containing leftover juice (86%) and clean and ready for sale (86%).

FIGURE 35: Dumpsite analysis, Bhubaneswar

TABLE 29: The dumpsite analysis conducted in Bhubaneswar

Truck	Total truck load	Mixed paper waste	UBC found in paper waste
Truck 1	5000 kg	92 kg	3 kg
Truck 2	8000 kg	145 kg	6 kg
Truck 3	8000 kg	170 kg	6.5 kg

The major concerns for not collecting UBC separately are as follows:

FIGURE 36: Waste collector interviewed, Chandigarh

- Lack of incentives for UBC collection
- Unavailability of buyers
- No developed markets
- Low weight of UBC

Waste collectors' response to the ways by which collection can be improved included good incentives to be provided for UBC collection, higher price should be offered at par with that of duplex paper and a proper market should be there for collection and recycling of UBC.

Small-Scale Dealer

Fourteen (14) small-scale dealers were interviewed across the city covering residential (93%) and commercial areas (71%). Around 5–70 ragpickers/kabadis contribute to these dealers. The average mixed paper handled by these dealers ranged from 450 kg/month to 2000 kg/month. All the dealers were collecting UBC along with the mixed paper. The purchase price of mixed paper has been indicated in the range of ₹4–12/kg whereas the selling price has been indicated as ₹ 7–15/kg indicating an increase in price in comparison to the previous study conducted in 2018 owing to a provision of better market and infrastructure for UBC collection and recycling. The source of procurement of UBC included ragpickers, door-to-door collectors, intermediate kabadi, and households. The condition of the procured UBC were reported as clean and ready for sale (100%) and containing leftover juice (100%). Upon asking the fate of UBC, all the dealers sell it to large-scale dealers along with the mixed paper.

FIGURE 37: Small scale dealer interviewed, Chandigarh

The major concerns as highlighted by small-scale dealers in dealing with UBC separately were indicated as:

- Lack of buyers in the market
- Lack of incentives for UBC collection
- Low value and weight of UBC

The suggested improvements by small-scale dealers were as follows:

- Buyers in the market
- Development of separate markets
- Providing good money for collection
- Increased value of UBC

Large-Scale Dealer

Seven large-scale dealers were interviewed across the city covering residential (86%), commercial (100%), and institutional areas (14%). About 20–50 kabadis/ragpickers were contributing to each of these dealers. The average mixed paper turnover ranged from 50,000 to 100,000 kg/month. All of the surveyed

TABLE 30: Bale analysis of small-scale dealers conducted in Chandigarh

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small scale scrap dealers	71.800	1.050	1.462
	90.900	0.750	0.825
	100.000	0.950	0.950
	46.500	0.300	0.645
	60.000	0.240	0.400
	29.600	0.250	0.845
	40.000	0.350	0.875
	25.000	0.250	1.000
	29.000	0.100	0.345
	40.000	0.150	0.375
	19.180	0.180	0.938
	20.000	0.150	0.750
	25.000	0.250	1.000
	24.000	0.110	0.458
Total	620.98	5.0800	0.818

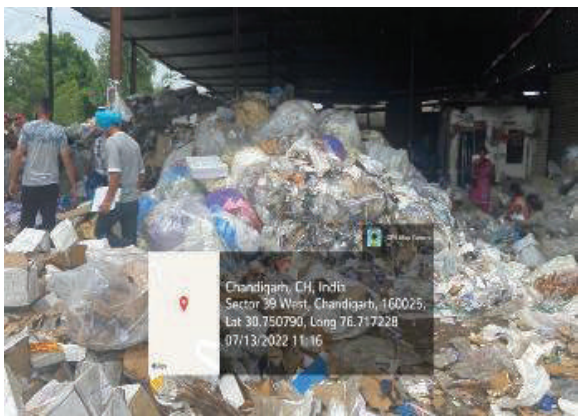


FIGURE 38: Bale analysis at large-scale dealer, Chandigarh

large- scale dealers reported of collecting UBC, out of 57% collected it separately whereas the remaining 43% collected UBC along with mixed paper waste. The average UBC collected by each of these dealers ranged from 30 kg/month to 1500 kg/month. The purchase price of UBC and mixed paper was indicated as ₹4–5/kg and ₹4–11/kg respectively whereas the selling prices were as ₹6–7/kg and ₹7–14/kg, respectively. Source of procurement of UBC included ragpickers (28%), door-to-door collectors (28%), intermediate kabadis (86%), and shops (57%). The condition of the procured UBC was reported by these dealers as 86% had juice content, and 86 % as clean and ready for sale. Upon asking the fate of UBC, it was mentioned that 86% sell it directly to the recyclers and 14 % sell it along with mixed paper. Upon asking the fate of straws it was mentioned that straws are often found inside the packs (43%) and sometimes found with packs (71%). Majority of the large scale dealers sold UBC to Tetra Pak's official city partner in Chandigarh – Gurditta Informatics.

The major challenges as highlighted by large-scale dealers in dealing with the collection and recycling of UBC were indicated as:

TABLE 31: Bale analysis of large-scale dealers conducted in Chandigarh

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
	71.600	14.300	19.972
	200.000	7.000	3.500
Large-scale scrap dealers	350.000	7.200	2.057
	200.000	3.000	1.500
	200.000	3.050	1.525
	150.000	4.850	3.233
	130.000	3.030	2.331
Total	1301.6	42.43	3.260

» Less resale values
» Insufficient time
» Less quantity

The suggested improvements by large-scale dealers were as follows:

» A better market for UBC collection and recycling
» Awareness on segregation at source level

Dumpsite Analysis

The dumpsite analysis was conducted at Daddu Majra dumpsite. Three trucks were unloaded at the dumpsite covering residential, commercial and institutional areas. The truck comprised of municipal solid waste wherein the mixed paper waste and the UBC were segregated and weighed in the end. It was observed that the quantity UBC was found in limited quantity as the recyclable waste, the mixed paper waste is already segregated at the material recovery facilities and the non-recyclable waste reaches the dumpsite.

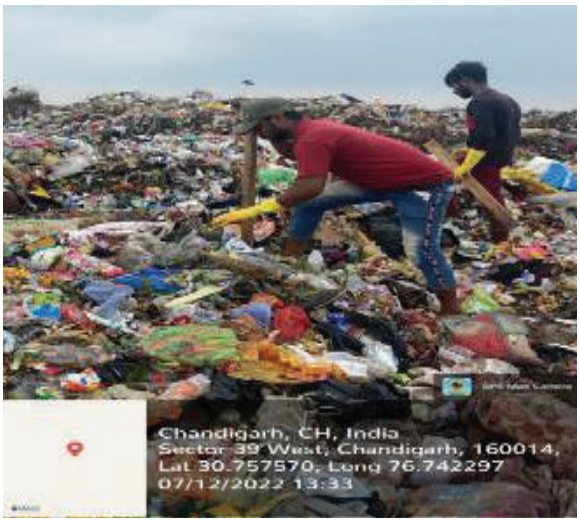


FIGURE 39: Dumpsite analysis at Daddu Majra, Chandigarh

TABLE 32: The dumpsite analysis conducted in Chandigarh

Truck	Total truck load	Mixed paper waste	UBC found
Truck 1	800 kg	1.5 kg	0.5 kg
Truck 2	1500 kg	1.5 kg	0.7 kg
Truck 3	800 kg	1 kg	0.6 kg

Thiruvananthapuram

Waste Collectors

In Thiruvananthapuram city, the waste collectors have formed a city circle among themselves. These waste management personnel or the Haritha Karma Sena, as locally called in Thiruvananthapuram, are formally included in Thiruvananthapuram Municipal Corporation (TMC). The door-to-door collection of waste is done with effective source segregation. The separated dry waste items include paper, plastic, UBC, metal, scrap, etc. However, UBCs are being collected by TMC as part mixed waste and is being sent to the recyclers along with the mixed paper waste. All waste collectors take UBC from local public dustbins and sell it to scrap dealers. After collection and segregation, UBCs materials are sent to large-scale dealers. Since UBCs are not widely available in Thiruvananthapuram, most large-scale dealers are not accepting UBC at their level.

FIGURE 40: Waste collector interviewed during survey in Thiruvananthapuram

The waste collector survey in Thiruvananthapuram interviewed ragpickers (54%) and Door-to-door collectors (81%). 41% of the respondents collected waste from households as well as from the streets from residential and commercial areas.

The surveyed collectors dealt with collecting paper (100%), plastic (100%), metal (100%), and cardboard (100%) as well as glass (63%). There were 72% of collectors collecting UBCs which increased by almost 10% in comparison to the study conducted in 2018 owing to an increase in price wherein, 18% collected UBCs separately and the rest collected it with mixed paper.

The average UBC collected per month ranged from 0.5 – 9 kg whereas the average mixed waste paper collected including UBC ranged from 0.25 – 3.5 tonnes/month. Selling price of UBC and mixed paper was informed to be ₹ 1 – 3/kg and ₹ 10 – 15/kg, respectively.

Mixed paper was procured primarily from households (100%), waste bins (64%), and markets (14%). It was responded that the upper and middle class localities and commercial establishments had UBC (100%) and 23% from lower income localities. Around 36% of the UBC collected did not contain leftover juice, 41% were soiled while majority 76% of the UBC were clean and ready for sale.

Points of concern indicated by surveyed waste collectors are as follows:

- Low value for UBC.
- Lack of buyers and market for UBC collection and recycling
- Low quantity UBC generation
- Manpower constraints for segregating UBC

When asked on how the collection of UBC can be improved, the dealers suggested the following:

- Higher incentive
- Building necessary facilities and acquiring the appropriate land and vehicles to manage wastes
- Awareness programs to promote segregation at source
- Development of infrastructure for collection, storage, segregation, transportation, processing and disposal of UBC

Small-Scale Dealers

Small-scale dealers interviewed had a monthly collection of about 3 to 40 tonnes of mixed waste paper. Stakeholders were involved in collecting mixed paper waste from commercial and residential areas. The ragpickers contributing to small scale dealers ranged in about 5 – 23 collectors in Thiruvananthapuram.

About 29% of the stakeholders interviewed accepted UBC along with mixed paper. The average UBC collected by each of these dealers varied from 0.5 kg/month to 9 kg/month. The purchase price of UBCs was ₹ 1/kg and purchase price of mixed paper varied from ₹ 10 to ₹ 16/kg. The selling price of UBCs to larger dealers was ₹ 1 to 3/kg and mixed paper varied from ₹ 10 to ₹ 18/kg.

According to dealers, UBC are obtained from households (100%), ragpickers (36%) and door-to-door collectors (64%). According to the small scale dealers

FIGURE 41: Bale analysis conducted at small-scale dealer in Thiruvananthapuram

dealing with UBC, 50% of the collected UBC contained leftover juice, 14% were soiled, and 57% were clean. Upon asking the fate of UBC stakeholders mentioned that about 50% sell it to large dealers and 14% sell it along with mix paper.

Concerns mentioned by small-scale dealers in Thiruvananthapuram are:

- Lack of knowledge and awareness
- High labour cost
- Very small amount of UBC collected

Improved infrastructure, good money, segregation and increased number of buyers are some of the factors that will enable more small-scale dealers to start dealing in UBC.

TABLE 33: Bale analysis of small-scale dealers conducted in Thiruvananthapuram

Category	Weight of bale analyzed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale scrap dealers	400	1.000	0.250
	400	1.210	0.303
	376	0.010	0.003
	300	0.040	0.013
	378	0.285	0.075
	389	0.100	0.026
	384	0.300	0.078
	409	0.040	0.010
	356	0.020	0.006
	400	0.040	0.010
	394	0.700	0.178
	402	0.030	0.007
	379	0.130	0.034
	376	0.000	0.000
Total	5344	3.905	0.073

Large-Scale Dealers

Six large scale dealers were surveyed and they had a monthly collection of mixed paper waste in the range of 50 to 70 tonnes. All the dealers received waste from both residential and commercial areas of the city. A large number of small scale dealers and ragpickers (ranging from 4 to 120) were supplying materials to each of these waste dealers.

All of the stakeholders were receiving UBCs along with mixed waste paper – however, only 33% of the large scale dealers were actively involved in UBC business. Average UBC collected by each of these dealers varied from 7 kg – 20 kg/month and the selling price of about ₹ 1/kg to ₹ 3/kg. Purchase price of mixed paper was indicated in the range of ₹ 2/kg to ₹ 15/kg and the selling price from ₹ 10/kg to ₹ 18/kg. All the respondents mentioned that the UBC received at their facilities was clean and ready for sale.

None of the large scale dealers were engaged in recycling of UBCs, they merely sold it to recyclers.

The points of concern of the large scale dealers included lack of designated market value, less buyers, low profitability margins as segregation of UBCs from mixed paper waste is labour intensive.

FIGURE 42: Bale analysis conducted at large-scale dealer in Thiruvananthapuram

Upon asking the possible motivations which can enable them to participate in segregating UBC for recycling, they suggested:

- Good number of buyers
- Awareness
- Separate bins for easy segregation of UBC
- A good price for UBC along with an awareness of its recyclability
- Improved infrastructure

TABLE 34: Bale analysis of large-scale dealer conducted in Thiruvananthapuram

Category	Weight of bale analyzed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Large-scale scrap dealers	250	0.75	0.300
	389	0.12	0.031
	405	0.1	0.025
	420	0.1	0.024
	400	0.25	0.063
	400	0.2	0.050
Average	377.3	0.3	0.082
Total	2264	1.52	0.067

Dumpsite Analysis

There is no dump site in Thiruvananthapuram. Palayam and Erumakuzhy were the major dumping sites in the city. However, as a part of Smart City Mission project, the dumping site at Palayam and Erumakuzhy were cleared. The city corporation remediated the dumping ground and converted it into park and garden. Thiruvananthapuram Municipal Corporation (TMC) also organizes periodical clean up drive, where citizens were asked to bring a specific type of non-bio degradable discards at pre-defined collection points in the city. The materials are directly sent to the authorized recyclers.

Kochi

Waste Collectors

Twenty-two waste collectors were interviewed in Kochi, including 2 ragpickers and 20 door to door waste collectors'. The ragpickers who are not formally linked into the waste management processes of the Kochi Municipal Corporation (KMC) are majorly found collecting paper, plastics, glass, metals and cardboards. Nearly 77% of the waste collectors were involved in the collection of UBCs out of which 18% collected separately and remaining collected along with the mixed paper waste. The average mixed paper handled by these waste collectors varied from 150 kg to 400 kg per month which is further sold to other small and large scale dealers at a rate of nearly ₹ 10/kg to ₹ 20/kg. The average UBC collected varied from 0.5 kg to 4 kg and was sold in the range of ₹ 1/kg to ₹ 2/kg. The source of procurement of UBC was majorly from household areas (100%), streets (18%), waste bins (50%) and market areas (32%). It was further reported that nearly 54% of the UBCs received were from the upper and middle class localities, 77% from commercial or business establishments and only 4% from lower income class localities. Of the collected UBCs, 18% were found with leftover juice inside it while 72% UBCs were clean and ready for sale.

FIGURE 43: Waste collector interviewed during survey in Kochi

The general concerns of the waste collectors regarding UBCs were:

» Low price in comparison to mixed dry waste
» Additional cost of manpower for segregation
» Lack of buyers in the market
» Lack of incentive

In order to improve the collection of UBCs, the respondents suggested that there should be designated collection centres for the collection of UBCs so that segregation is practised and the collected UBCs are channelized through a formal channel. The price of the UBCs needs to be increased similar to that of duplex paper. Along with this there needs to awareness and behavioural change amongst the people.

Small-Scale Dealers

In Kochi, fourteen small-scale dealers were surveyed. These waste collectors were receiving waste from various residential and commercial areas. Supplying to these dealers were nearly 2 to 36 ragpickers/ kabadiwallahs. The total average mixed paper waste collected per month varied from 200 kg per month to 5000 kg per month. The purchase price of mixed paper waste ranged from ₹ 7/kg to ₹ 16/kg and the selling price was in the range of ₹7/kg to ₹ 20/kg. It was reported that nearly 50% of the dealers were accepting UBCs along with mixed paper. The average

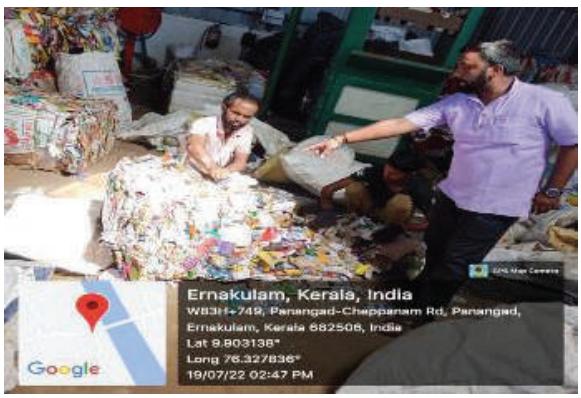


FIGURE 44: Bale analysis conducted at small-scale dealer, Kochi

UBC collected per month varied from 1 kg/month to 20 kg/month. The small-scale dealers purchased UBCs at ₹ 1/kg whereas it is sold at the rate of ₹1/kg to ₹ 3/kg. The major source of procurement of UBC are mainly the household areas (76%), intermediate ragpickers (21%) and door to door waste collectors (64%). The majority of UBCs recovered are sold to large scale dealers at low price after being mixed with paper waste. Around 64% of the UBCs were found in clean condition and ready for sale whereas remaining were often found in soiled conditions. The straws are also found within the pack itself and along with the dry waste is sold to the large-scale dealers without any processing or treatment.

The reasons as mentioned by the small-scale dealers for not dealing with the collection of UBCs are as follows:

» Low quantity and weight of the UBCs
» Lack of storage space and infrastructure
» Less price in comparison to that plastics or cardboards

In order to maximize the collection efficiency of UBC, the small scale waste dealers suggested that there should be higher price for the collected material. There should be waste segregation at the source level itself. Along with this, technological advancements and proper infrastructure can scale up the collection.

The conducted bale analysis of small scale dealers in Kochi is as follows:

Large-Scale Dealers

Seven large scale dealers were surveyed across Kochi who were dealing with waste coming from residential and commercial areas. About 25 to 140 ragpickers/kabadiwallahs provided materials to these large scale dealers. The total average mixed paper waste collected at these large-scale dealers varied from 3000 kg per month to 1,00,000 kg per month. The waste dealers purchased mixed paper

TABLE 35: Bale analysis of small-scale dealers conducted in Kochi

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale dealers	400	0.6	0.150
	290.1	8.3	2.861
	421	1.62	0.385
	300	0.2	0.067
	394	0.18	0.046
	108	0	0.000
	384	0.12	0.031
	129	0.02	0.016
	347.2	0.1	0.029
	364.69	0.75	0.206
	278.51	0.01	0.004
	317	0.21	0.066
	413	0.1	0.024
	400	1.3	0.325
Total	4564.5	13.510	0.297

FIGURE 45: Large scale dealer interviewed during survey, Kochi

waste at a rate ranging from ₹ 7/kg to ₹ 10/kg and is sold at the rate of ₹ 10/kg to ₹ 20/kg. It was observed that all the large-scale waste dealers were collecting UBCs, with about 14% of the dealers collecting it separately whereas the remaining 86% collecting it along with mixed paper waste. The UBC collected per month varied from 2 kg to 55 kg. The purchase price of UBCs was in the range of at the rate of ₹1/kg to ₹ 3/kg and sold at a rate of ₹ 3/kg to ₹ 7/kg. The source of procurement of UBCs are majorly from household areas, commercial areas, ragpickers and door to door waste collectors. The UBCs collected are mostly in clean condition with straws found within the pack. They are sold along with mixed paper waste to recyclers without any treatment. Due to the high selling prices of recyclable paper materials like newspaper, books, duplex paper, and cardboard, majority of the large scale dealers do not deal with UBC separately.

The reasons and concerns of the large scale dealers pertaining to UBC dealing are highlighted below:

- Low value and weight
- Lack of buyers in the market
- Less price is offered in comparison to other recyclable materials such as duplex paper
- Lack of manpower and additional cost of manpower will be incurred for segregation
- Lack of storage space
- Lack of incentives
- The soiled condition of the UBC makes the dry waste facility prone to rodents attacks

In order to maximize the collection efficiency of UBCs, the dealers suggested that there should adequate infrastructure, advancement in technology and well-coordinated network for collection. Along with this higher price should be offered for UBCs.

The conducted bale analysis of large scale dealers in Kochi is as follows:

TABLE 36: Bale analysis of large-scale dealers conducted in Kochi

Category	Weight of bale analysed (kg)	Weight of UBCs found (kg)	% of UBCs
Large-scale dealers	488	2.1	0.4
	452	0.6	0.1
	365	3.2	0.9
	262	3.7	1.4
	421	0.6	0.1
	358	0.7	0.2
	384	2.4	0.6
Total	2731	13.2	0.5

Dumpsite Analysis

The dumpsite analysis took place at the Kochi Dumpsite in Brahmapuram. Three trucks with waste from residential, commercial, and institutional areas were unloaded at the dumpsite. The trucks were loaded with mixed municipal waste, from which mixed paper waste and UBCs were segregated.

FIGURE 46: Dumpsite analysis conducted at Brahmapuram, Kochi

TABLE 37: The dumpsite analysis conducted in Kochi

Truck	Total truck load	Mixed paper waste	UBC found in paper waste
Truck 1	1165 kg	160 kg	0.710 kg
Truck 2	3680 kg	368 kg	1.67 kg
Truck 3	4210 kg	410 kg	2 kg

Mysuru

Waste Collectors

In Mysuru city, 22 waste collectors were surveyed during the course of this study where 27% were ragpickers and the remaining were door to door waste collectors that covered residential and commercial areas. The waste collectors are involved in the collection of dry recyclables such as plastics (100%), paper (100%), glass (100%), metal (36%), cardboards (100%) etc. Of the surveyed waste collectors, 63%

FIGURE 47: Waste collector interviewed during survey in Mysuru

were involved in the collection of UBCs. The UBCs are collected along with mixed paper waste and are further sold to small scale or large scale dealers. The average UBC collected per month varies from 30 kg to 2,000 kg, while the average mixed paper waste collection varied from 2,400 kg to 12,000 kg per month. The UBC is sold in the range of ₹ 4/kg to ₹ 6/kg whereas mixed paper waste is sold at a higher rate of ₹ 6/kg to ₹ 15/kg, an increase in prices for both UBC and mixed paper in comparison to 2018 study. The source of procurement of UBCs is mainly from the household areas comprising of middle and upper income class localities as well as from commercial areas. The UBCs collected is mostly in clean condition.

The reasons as highlighted by the waste collectors for not dealing with the collection of UBCs are highlighted as below:

» Less price offered in comparison to other dry recyclables materials
» Low value and weight
» Contaminated material

In order to improve the collection of UBCs, the waste collectors suggested to increase the price of UBCs similar to that of cardboard and a robust network of market should be there.

Small-Scale Waste Dealers

In Mysuru, 14 small scale dealers were surveyed across the city covering residential and commercial areas. Around 5-30 ragpickers and door to door waste collectors contribute in the provision of recyclable materials to these small scale dealers. These dealers are considered as Dry Waste Collection Centres (DWCCs) in the city. The average mixed paper waste handled at their facilities varies from 2,000 kg per month to 24,000 kg per month. Unlike the 2018 study, there is an increase in the purchasing and selling price of mixed paper , wherein purchase price varied from ₹ 3/kg to ₹ 20/ kg and is sold at the rate of ₹ 8/kg to ₹ 25/kg. Around 79% of the waste dealers collect

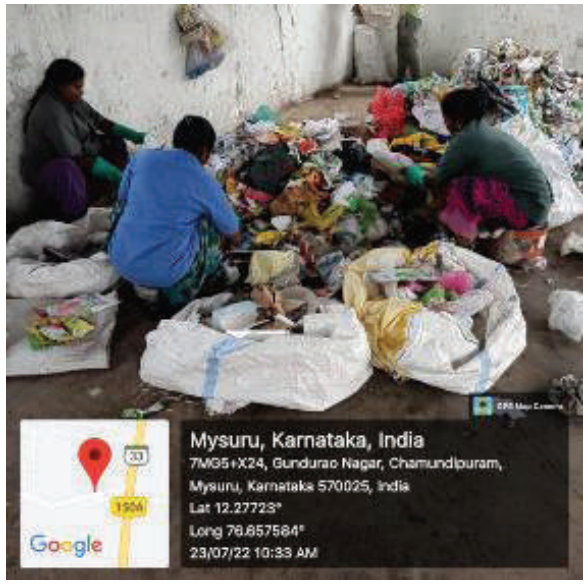


FIGURE 48: Bale analysis conducted at small-scale dealer, Mysuru

UBCs along with the mixed paper waste and then further sell it to other dealers or recyclers. The major source of procurement of UBCs is from households, commercial areas and intermediate kabadiwallahs. The UBC collected are mostly found in soiled condition as reported by the dealers.

The reasons as highlighted by the small scale dealers for not dealing with UBC collection are mentioned below:

» Lack of labour and additional cost of manpower will be incurred
» Lack of storage space
» Less price
» Material is prone to contamination and pest attacks

In order to maximize the collection of UBCs, the waste dealers suggested that there should be increase in the price of UBCs similar to that of other dry recyclable materials and awareness amongst the people to provide clean material.

TABLE 38: Bale analysis of small-scale dealers conducted in Mysuru

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC(%)
Small-scale dealers	256	0.4	0.156
	207	1.8	0.870
	312.8	1.9	0.607
	256.53	0.5	0.195
	245.7	0.65	0.265
	265.9	2.2	0.827
	218.5	0.625	0.286
	223.4	1.25	0.560
	135	0.1	0.074
	35.4	0	0.000
	180	0.1	0.056
	261	17.5	6.705
	294.9	38	12.886
	379.8	24	6.319
Total	3271.93	89.025	2.721

Large-Scale Vendors

Five large scale dealers were surveyed during the course of this study who dealt with waste coming from both residential and commercial areas. There were nearly 13-20 ragpickers associated with these dealers for provides materials. The average mixed paper waste handled at large scale dealer level varied from 60,000 kg per month to 1,00,000 kg per month. The purchasing price of the mixed paper waste varied from ₹ 8 /kg to ₹ 10 /kg and the selling price was in the range of ₹ 14 /kg to ₹ 25 /kg. Of all the surveyed dealers, around 80% received UBCs along with mixed paper waste, while 17% were not involved in its collection. The UBCs collected varied from 85 kg per month to 1,20,000 kg per month. The purchase price of UBCs is in the range of ₹ 8 /kg to ₹ 10 /kg and the selling price is from ₹ 13/kg to ₹ 15 /kg. The source of procurement of UBCs are from households (33%), ragpickers (83%), door to door waste collectors (33%), intermediate kabadiwallas (67%) and commercial areas (67%). In 50% of the cases the UBCs were clean and ready for sale while remaining were found in soiled condition. At the large scale dealers, no processing or treatment facility takes place and along with the mixed paper waste is sold to the recyclers.

FIGURE 49: Large-scale dealer interviewed during survey, Mysuru

The reasons as highlighted by the large scale dealers for not collecting UBCs are discussed as below:

- Lack of space
- Less price
- Sorting labour is expensive

In order to maximize the collection of UBCs, the high price and incentive should be provided to ragpickers and door-to-door waste collectors.

TABLE 39: Bale Analysis of large scale dealer conducted in Mysuru

Categories	Weight of bale analysed (kg)	Weight of UBC found (kg)	% of UBCs
Large-scale Waste Dealers	458.8	8.5	1.853
	517.91	12.1	2.336
	497.4	10.2	2.051
	264.6	0.1	0.038
	403.6	6	1.487
Total	2142.31	36.9	1.722

Dumpsite Analysis

The dumpsite analysis was conducted at Mysuru Dumpsite in Visveshwara Nagar. Three trucks were unloaded at the dumpsite with waste containing from the residential, commercial, and institutional areas. The trucks contained mixed municipal waste from which the mixed paper waste and UBCs were segregated. A total of 13,450 kg of mixed waste was analysed and about 124.1 kg of mixed paper waste was segregated. After the analysis, 8.407 kg of UBC was found.

FIGURE 50: Dumpsite analysis conducted at Visveshwara Nagar, Mysuru

TABLE 40: Dumpsite analysis conducted in Mysuru

Truck	Total truck load	Mixed paper waste	UBC found
Truck 1	12670 kg	27 kg	1.92 kg
Truck 2	22430 kg	24.1 kg	2.314 kg
Truck 3	38350 kg	73 kg	4.173 kg

Bengaluru

Waste Collectors

In Bengaluru, 22 waste collectors were surveyed during the study wherein 72% were door to door waste collectors and the remaining 28% were ragpickers. They are involved in the collection of multiple recyclables like paper (100%), plastics (100%), glass (90%), metals (81%), and cardboard (100%). Of all the waste collectors surveyed, 13% are not involved in the collection of UBCs whereas the remaining 87% collect UBCs along with mixed paper waste owing to

FIGURE 51: Waste collector interviewed during survey, Bengaluru

an increase in price in comparison with 2018 study. The average mixed paper waste collected per month by the surveyed collector's ranges from 250 kg to 10,000 kg per month and is sold at a rate of nearly ₹ 8/kg to ₹ 14/kg. The waste collectors involved in UBC collection estimated the collection in a range of 25 kg to 900 kg per month which is sold at a rate ₹ 6/kg to ₹ 7/kg approximately. The source of procurement of UBCs are mainly from the household areas, streets and commercial or business establishments mostly from the bars since, significant amount of liquor is packed in beverage cartons in Bengaluru. The bar owners give the segregated waste to either Municipal Conservancy Workers or ragpickers, who then sort and clean it before giving it to small vendors. When some UBC is collected as part of wet waste from residences, conservancy workers do not remove it due to lack of time and incentive, and it eventually ends up at the dump site. However, majority of the collectors are aware of the UBC monetary value and do not overlook it.

The mixed paper waste collection was in the range of about 250 kg to 10,000 kg per month and is sold at a higher rate than that of UBCs around ₹ 8-10/kg.

The reasons stated by the waste collectors for not collecting the UBCs separately are mentioned below:

- Lack of buyer or market
- Lack of incentives as UBCs along with mixed paper waste gives a higher price in comparison to when sold separately
- Low weight and value

Respondents suggested that segregation at source is needed and a proper connection between different stakeholders is the key to proper segregation and collection of UBCs. Also, a good price and market for UBCs is required to motivate various players in recycling business to get UBCs collected for recycling. Some even suggested that a contract must exist with shopkeepers so as to collect the waste directly in large quantities. Adequate amount of awareness is needed in this city for this to happen.

Small-Scale Waste Dealers

Fourteen small scale waste dealers were surveyed during the study. In Bengaluru, the small scale dealers and other regular waste dealers are considered as Dry Waste Collection Centres (DWCC) who are spread across the city. The dealers were capturing waste from the households, commercial institutes and approximately 6 to 26 intermediate ragpickers and kabadiwallahs. All but one small scale dealers were involved in the collection of UBCs along with mixed paper. If the UBC quantum is less, they sell it along with Colour Record (Mixed Paper Waste) or with cardboard and send to mill. This reduces their labour cost and also returns higher revenue. When UBC is in larger quantity they keep it separately and give to large dealers.

The average mixed paper waste collected at small scale dealer level is in the range from 5,500 kg to 45,000 kg per month with a purchase price ranging from ₹ 5.5/kg to ₹ 15/kg while the selling price being around ₹ 7/kg to ₹ 17/kg. The amount of UBC received was reported to be in the range of around 900 kg to

FIGURE 52: Small-scale dealer interviewed during survey, Bengaluru

2000 kg per month, with a purchase price of about ₹ 4/kg to ₹ 6/kg and the selling price being in the range of ₹ 8/kg to ₹ 12/kg. Unlike the 2018 study, there has been an increase in the purchase and selling price of UBC and mixed paper respectively.

The discouraging factors as stated by the dealers in dealing with the UBCs separately are mentioned below:

- Lack of awareness
- Lack of storage space
- Lack of buyer in the market
- Low market value

Additional cost of labour to get involved in segregation of UBCs from mixed paper waste.

As per the suggestions given by the small-scale dealers, in order to improve the collection of UBCs, along with the awareness generation there needs to be increase in price of the UBCs at par with the mixed paper waste or duplex waste and incentives needs to be provided for segregation of waste.

Large-Scale Vendors

Fifty large scale dealers are located in the city of Bengaluru. About 7 large scale dealers were surveyed during the study dealing with approximately 6,000 kg per month – 1,00,000 kg per month mixed paper waste. The large scale dealers capture waste from residential, commercial, institutional and other small scale dealers and intermediate kabadiwallahs (approximately 6-30). The UBCs collected were in the range of 1,500 kg to 10,000 kg per month (mostly along with mixed paper waste) and were sold at a rate ranging from ₹ 10/kg to ₹ 15/kg to other large scale dealers and recyclers along with the mixed paper waste. 86% of the large scale dealers were accepting UBC along with mixed paper waste, while no surveyed large scale dealer was accepting UBC individually. The straws are mostly found within the pack and are further sold along with the UBC.

TABLE 41: Bale analysis of small-scale dealer conducted in Bengaluru

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Small-scale dealers	207.7	0.35	0.169
	469.15	5.85	1.247
	281.75	2.2	0.781
	238	4.5	1.891
	326.5	6	1.838
	273.8	7.25	2.648
	395	15.8	4.000
	236.15	8.3	3.515
	220.16	4	1.817
	195.55	3.35	1.713
	245	2.8	1.143
	233.5	0.4	0.171
	256.4	2.25	0.878
	225.4	2.05	0.909
Total	3804.06	65.1	1.711

FIGURE 53: Bale analysis conducted at large-scale dealer, Bengaluru

The major concerns highlighted by large scale dealers in dealing with UBCs are highlighted below:

» Lack of buyers in the marker
» Segregation labour cost is more
» Less price, if sold separately
» Less quantity in collection

The surveyed candidates suggested in order to improve the collection rate of UBCs, along with awareness amongst the stakeholders, there should be incentive and higher price similar to that of duplex paper.

TABLE 42: Bale analysis of large-scale dealer conducted in Bengaluru

Category	Weight of bale analysed (kg)	Weight of UBC found (kg)	% of UBC found
Large-scale Waste Dealers	449.5	12.45	2.770
	480	7.02	1.463
	424.95	12.65	2.977
	488.7	10.4	2.128
	517	12.95	2.505
	350.4	3.32	0.000
	419.8	4.02	0.958
Total	3130.35	62.81	2.006

Dumpsite Analysis

The dumpsite analysis was conducted at Mitganahalli, Bellahalli in Bengaluru. Three trucks were unloaded at the dumpsite with waste containing from the residential, commercial, and institutional areas. The trucks contained mixed municipal waste from which mixed paper waste and UBCs were segregated. A total of 24,890 kg of mixed waste was analysed and about 48.3 kg of UBCs was found, which is approximately around 0.194% of the total waste.

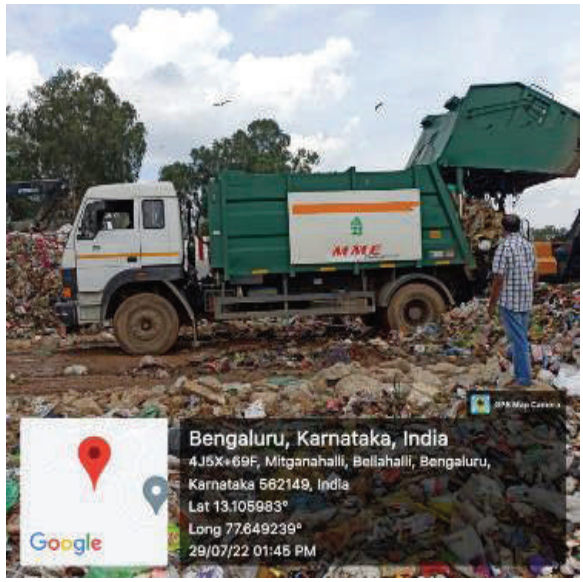


FIGURE 54: Dumpsite analysis conducted at Mitganahalli, Bengaluru

TABLE 43: Dumpsite analysis conducted in Bengaluru

Truck	Total truck load (in kg)	UBC found (in kg)
Truck 1	8300 kg	15.3 kg
Truck 2	8170 kg	14.2 kg
Truck 3	8420 kg	18.8 kg

Hyderabad

Waste Collectors

In Hyderabad about 32 waste collectors were surveyed, which included door to door waste collectors (81%) and ragpickers (19%). The waste comes from residential, institutional, and commercial areas to the collectors, and all type of dry waste including plastics (84%), papers (93%), glass (38%), metal (13%), cardboard (16%), and styrofoam (31%) is collected. About 84% of waste collectors reported of collecting UBCs. The surveyed waste collectors responded about 19% collect UBC separately while 75% are indulged in collecting UBC along with mixed paper/cardboard waste. The reasons for not collecting

UBC were mentioned as there are no incentives on UBC collection and no buyer/market is established for the collected UBC.

The average monthly UBC collected by each of the collectors varied from 2 kg to 150 kg. The collectors dealing in UBC estimated a monthly mixed paper waste of about 4 kg/month to 350 kg/month. The selling price of UBC has been indicated as ₹ 2/kg to ₹ 5/kg whereas price of mixed paper varied from INR 12 - 18/kg. The mixed waste was procured from households by 87%, street by 40%, waste bins by 50%, and markets by 9%. About 96% Stakeholders mentioned that UBCs were coming from upper and middle income localities, 25% reported from commercial and business establishments and 9% mentioned from lower income localities. Upon asking about the condition of the UBCs collected, 90% interviewed stakeholders reported that UBCs were not containing juice in it and 9% mentioned that the UBCs as soiled packs. On being asked the fate of UBC, 100% stakeholders mentioned they sell it with mix paper to dealers.

The major discouragement for not collecting UBC separately is that there are no buyers for the collected UBCs. Waste collectors suggested that the collection & recycling of UBCs may improve if separate bins for UBCs are used, good price is provided for collection and segregation, provide incentives, and establish buyers/markets for the collected UBCs.

Small-Scale Waste Dealers

Fourteen small scale dealers were interviewed in different areas of Hyderabad, each having a turnover of about 120 kg to 30,000 kg of mix waste paper every month. The stakeholders covered residential, institutional and commercial areas. A large number of small scale dealers and ragpicker about 10 – 75 were supplying materials to each of these waste dealers. The stakeholders interviewed mentioned that about 93% of them were collecting UBC out of which 33% collected UBCs along with mixed paper. The average

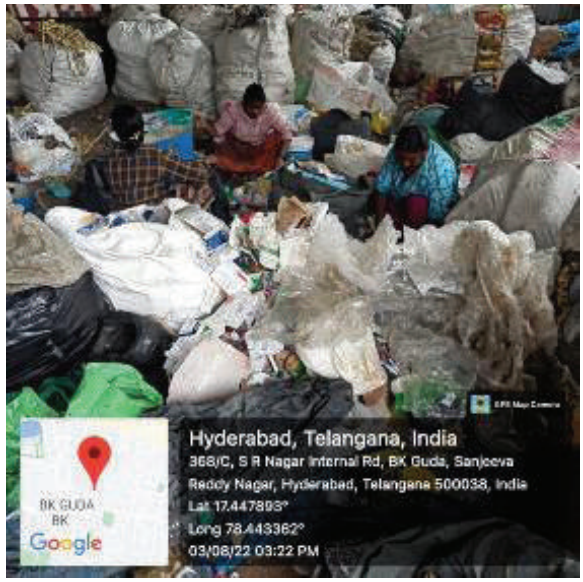


FIGURE 55: Bale analysis conducted at small-scale dealer, Hyderabad

UBC collected by each of these dealers varied from 20 kg/month to 50kg/month. The purchase price of UBCs was ₹ 2-7/kg and purchase price of mixed paper varied from ₹ 2-10/kg. The selling price of UBCs to larger dealers was ₹ 2-12/kg and mixed paper varied from ₹ 6-12/kg. The dealers reported that UBCs come to them via households (60%), ragpickers (40%), door to door collectors (40%), others (30%) including hotels, shopping malls, markets and dustbin, and intermediate kabadi's (20%). 100% of the dealers dealing with UBC reported its condition as containing leftover juice, and 10% of them responded as clean and ready for sale. Upon asking the fate of UBC stakeholders mentioned that about 100% sell it to large dealers and 60% sell it along with mix paper.

The key challenges as highlighted by small scale dealers in dealing with the collection of UBC included lack of proper market and buyers. . The collection of UBC can be improved by providing good money on UBC purchasing and by providing good incentives for the collection of UBCs.

TABLE 44: Bale analysis done at small scale dealers in Hyderabad

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Small-scale dealers	445	7	1.573
	563	12.75	2.265
	385	3.25	0.844
	435	10	2.299
	505	8.75	1.733
	425	8.5	2.000
	435	6.5	1.494
	405	6.5	1.605
	430	5.5	1.279
	427	7	1.639
	207	0	0.000
	460	14	0.117
	418	11	2.632
	409	5.5	1.345
Total	5949	106.25	1.786

Large-Scale Vendors

Seven large scale scrap dealers were interviewed, each having a turnaround of about 28 -2000 kg of mixed waste paper every month. The stakeholders covered residential, commercial, and institutional areas of city. A large number of small scale dealers and ragpickers about 20–60 were supplying materials to each of these waste dealers.

Out of the dealers interviewed, all of them collected UBC, out of which 50% of the dealers collected UBCs separately and the remaining collect it along with mixed paper. The average UBC collected by each of these dealers varied from 2.3 kg/month to 80 kg/month. Purchase price of UBC was indicated in range of ₹ 2-6/kg and selling price of UBC varied from ₹ 3-9/kg. Purchase price of mixed paper was indicated in range of ₹ 5-12/kg and a selling price of paper varied from ₹ 6-15/kg.

FIGURE 56: Large-scale dealer interviewed during survey, Hyderabad

The stakeholders reported that UBCs come to them via intermediate kabadi's (33%) and other areas such as hotel, airport, malls, dustbins and factories (66%). 100% of the dealers responded that most of the UBCs procured contain leftover juice. 66% of the stakeholders mentioned that they sell the UBCs along with mixed paper, and 33% of them sell it further to large scale dealer.

Stakeholders reported major discouragement for not collecting UBCs as; no money provided on collecting and no buyer. These stakeholders also suggested that improved market value, good price and more awareness can definitely drive the UBCs recycling chain in Hyderabad.

TABLE 45: Bale analysis done at large scale dealers in Hyderabad

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Large-scale dealers	425	11	2.588
	573	7	1.222
	414	2.75	0.664
	407	10.5	2.580
	414	10	2.415
	416	8	1.923
	465	9	1.935
Total	3114	58.25	1.871

Dumpsite Analysis

Waste coming from residential and commercial areas was analysed at Jawaharnagar dump yard with waste containing from residential, commercial and institutional areas of Hyderabad. The trucks contained municipal waste from which the mixed paper waste and UBCs were segregated and weighed.

FIGURE 57: Dumpsite analysis at Jawaharnagar Dumping Yard, Hyderabad

TABLE 46: Dumpsite analysis in Hyderabad

Truck	Total truck load	Mixed paper waste	UBC found
Truck 1	9060 kg	58 kg	0.12 kg
Truck 2	10160 kg	24.1 kg	0.43 kg
Truck 3	9840 kg	76 kg	0.39 kg

Nagpur

Waste Collectors

Majority of the surveyed waste collectors in Nagpur did not collect UBCs during the rainy season and also reflected that the market of UBCs has changed massively over the last few years since no small or large scale dealer is accepting UBC at their level. They have thus started discarding the UBCs accumulated accidentally in nearby municipal dustbins. The UBC is rejected at this point in the waste value chain as

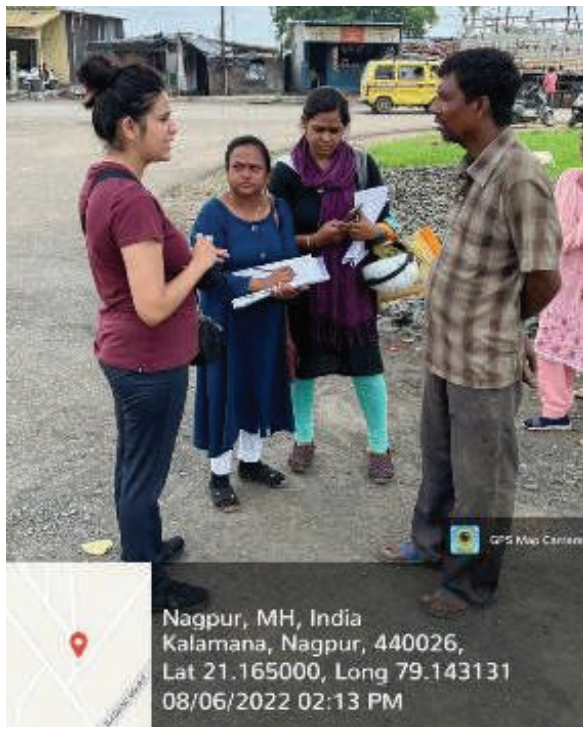


FIGURE 58: Waste collector interviewed during survey, Nagpur

there is no price for separate collection of UBC in the market and hence, waste collectors avoid collecting UBCs. In order for the ragpickers to start collecting UBC, the price equivalent to that of mix waste paper or cardboard per kg should be kept for them. It was found that many waste collectors were picking up the waste like PET bottles, plastics, cardboards from entire Nagpur and later selling it to the small and large scale dealers. Since there is no value of UBC it is not collected.

A total of 22 waste collectors were interviewed during the survey in Nagpur and these included all of the ragpickers covering residential, commercial areas spread across the city. Paper, plastics, metals, glass, and styrofoam were collected by the collectors. Only 9% of the dealers were collecting UBCs along with mixed paper waste. As a result of underdeveloped markets and no incentives, other waste collectors did not collect UBC.

Average mixed waste paper collected per month was around 100 to 600 kg and selling price was ₹ 15/kg to ₹ 20/kg. The sources of procurement of mixed waste paper including UBCs were households (100%), streets (100%), waste bins (95%), and markets (95%).

When asked the reasons that discouraged them to segregate, the following replies were obtained:

» Less number of UBCs
» No incentives for UBCs collection
» No buyers in the market

According to waste collectors, UBCs collection can be improved by providing adequate storage space and a fair price.

Small-Scale Dealer

Small scale scrap dealers were surveyed spread across the city of Nagpur and these were dealing with residential and commercial areas. The number of ragpickers contributing to each of these dealers

FIGURE 59: Small-scale dealer interviewed during survey, Nagpur

were around 7 to 35. The total monthly average mixed waste paper handled by these dealers was around 0.75 tonne to 35 tonne. Average purchase price of mixed paper ranged from ₹ 10/kg to ₹ 20/kg. The selling price of mixed paper was reported to be between ₹ 15/kg to ₹ 25/kg. Unlike the 2018 study, there is an increase in the purchase and selling price of mixed paper.

Only one of the dealers was collecting UBC with mixed paper waste, the reason being labour shortage and not receiving sufficient quantity, especially during the rainy season. The source of procurement of UBC included only households. When asked about the condition of the UBCs, the respondent reported they were clean and ready for sale.

Points of concern raised by small scale dealers for dealing with UBCs indicated were as follows:

» Very less quantity
» No dealers in the market
» Space constraints
» No incentives
» No buyer

The dealers suggested high incentives can improve further UBCs collection for recycling.

TABLE 47: Bale analysis of small-scale dealers conducted in Nagpur

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale scrap dealers	61.1	0	0.000%
	53	0	0.000%
	50	0	0.000%
	90.9	0	0.000%
	72	0	0.000%
	70.45	0	0.000%
	23.2	0	0.000%
	37.21	0	0.000%
	35.7	0	0.000%
	125.7	0	0.000%
	777	0	0.000%
	70.77	0	0.000%
	57	0	0.000%
Total	1524.03	0	0.000%

Large-scale Dealer

Seven large-scale dealers were surveyed during the study in Nagpur, dealing in multiple waste streams coming from residential, commercial and institutional areas. Nearly 10 to 35 ragpickers and small scale dealers were engaged under these dealers. The total average mixed paper waste collected was about 1 tonne to 200 tonnes per month. The average purchase price of mixed paper was between ₹ 18/kg to ₹ 25/kg while the average selling price was in the range of ₹ 20/kg to ₹ 33/kg. Unlike 2018 study, none of the large scale dealers in Nagpur were collecting UBCs, since they did not have the labour to segregate UBC and also due to the lack of ready buyers.

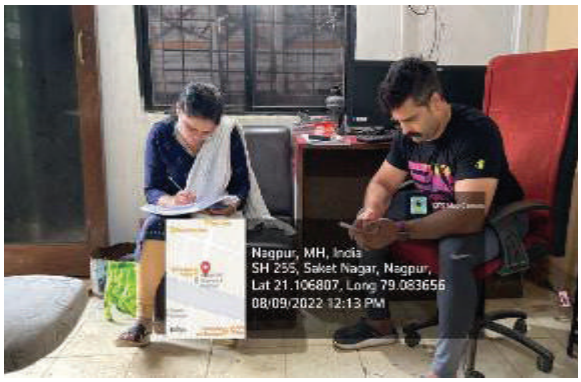


FIGURE 60: Large-scale dealer interviewed during survey, Nagpur

The concerning points raised by large scale dealers for dealing with UBC were:

- Very less quantity of UBC is generated in comparison to other wastes
- Extra labour is needed
- Storage problem

The suggested improvements by large scale dealers were as follows:

- Increase in rates and incentives
- Awareness among the residents and waste collectors
- Separate buyers for UBCs

TABLE 48: Bale analysis of large-scale dealer conducted in Nagpur

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Large-scale scrap dealers	331.550	0.000	0.000
	156.500	0.000	0.000
	353.600	0.000	0.000
	410.900	0.000	0.000
	309.800	0.000	0.000
	289.000	0.000	0.000
	164.500	0.000	0.000
Total	2015.85	0	0.000

Dumpsite Analysis

Bhandewadi dumpsite analysis was conducted in Nagpur. During TERI's visit, the primary dumping site was inaccessible for sampling due to rain. However, Nagpur Municipal Corporation (NMC) agreed to allow sampling of 3 trucks within their vicinity. The selected trucks contained mixed waste and were arriving from residential, commercial and institutional areas. The quantity of UBC found was very low at the dumpsite. The reason for this provided by NMC official was that the consumption of juice and other beverages is very low during the rainy season.

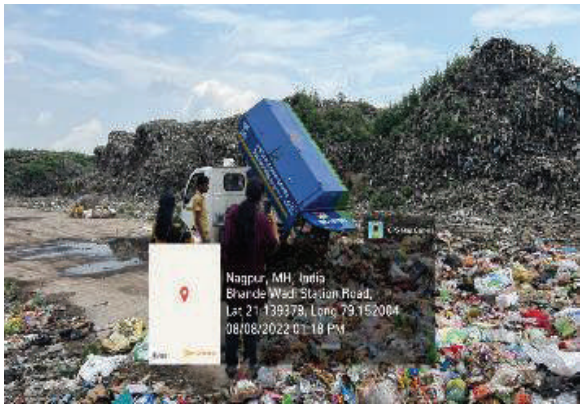


FIGURE 61: Dumpsite analysis at Bhandewadi dumpsite, Nagpur

TABLE 49: Dumpsite analysis in Nagpur

Truck	Total truck load	Mixed paper waste	UBC found
Truck 1	1200 kg	28 kg	0.5 kg
Truck 2	470 kg	10 kg	0.2 kg
Truck 3	690 kg	16 kg	0.1 kg

Kurnool

Waste Collectors

Twenty two waste collectors were surveyed in Kurnool, who were both ragpickers (73%) and door-to-door waste collectors (27%). The surveyed ragpickers preferred collecting waste of higher value like plastics, metals, or mixed paper waste. The household waste is collected by municipality workers and the ragpickers do not get waste directly from households. Waste collectors/ragpickers roam the city and collect the waste from waste bins. All the surveyed collectors were dealing with plastics (100%), papers (100%), cardboard (100%), metal (100%) and glass (45%). None of them were directly collecting UBCs, however, they were receiving a few cartons along with mixed paper waste. Lack of involvement of waste collectors for dealing with UBCs are lesser incentives, lack of dedicated buyers and low level of awareness about UBCs.

Upon being asked about the source of procurement of mixed waste paper, collectors reported they collect it from households (27%), streets (90%), waste bins (100%), markets (90%), and other institutional places (72%). The estimated mixed paper waste collected was in the range of 200 kg/month to 650 kg/month. The selling price of mixed paper varied from ₹ 10/kg

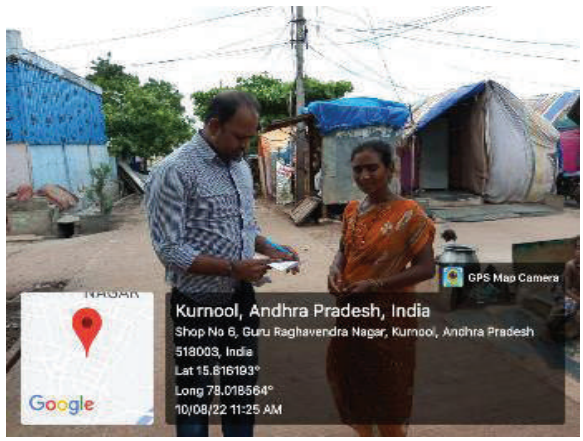


FIGURE 62: Waste collector interviewed during survey, Kurnool

to ₹ 16/kg. The majority of the stakeholders reported UBCs coming from upper middle-class localities and commercial establishments. However, interviewed stakeholders reported the condition of UBCs packs reaching them containing juice in it and were often soiled. In view of the small amount of UBCs collected, there are no buyers, and a very small amount is paid for collecting UBCs separately.

Waste collectors responses of the ways by which collection can be improved were as follows:

» Better market for UBC collection and recycling

» Higher selling and purchasing price

Small-scale Dealers

Fourteen small scale dealers were surveyed spread across the city of Kurnool and these were dealing with wastes from residential, commercial and institutional areas. The number of ragpickers contributing to these dealers were around 6 to 25. The average mixed waste paper handled by these dealers was in the range of 300 kg to - 45 tonnes/month. All of the small scale dealers interviewed were not collecting UBCs individually due to the lack of a dedicated market and relatively lower price incentives. However, 86% of the dealers were accepting UBC along with mixed paper waste.

FIGURE 63: Small-scale dealer interviewed during survey, Kurnool

The mixed paper buying prices were reported in the range of around ₹ 8/kg to ₹ 20/kg, and selling prices were in the range of ₹ 12/kg to ₹ 30/kg. The dealers accepting UBC along with mixed paper waste reported UBCs to come to them via Households and ragpickers. Major discouragement is less incentives for UBC, and lack of an organized market. The collection of UBC can be improved by providing higher incentives on UBC collection and segregation.

TABLE 50: Bale analysis of small-scale dealer conducted in Kurnool

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale scrap dealers	35	0	0.000
	68	0.75	1.103
	67.22	0.5	0.744
	23.3	0.375	1.609
	26.5	0.37	1.396
	56.9	0.41	0.721
	64.1	0.45	0.702
	72.8	0.5	0.687
	66.2	0.4	0.604
	61.6	0.51	0.828
	340	0.394	0.116
	375	0. 44	0.117
	370	0.42	0.114
	259	0.36	0.139
Total	1885.62	5.439	0.288

Large-Scale Dealer

Seven large scale scrap dealers, predominantly dealing with mixed paper waste were interviewed, each having an average collection of about 125 tonnes to 300 tonnes of mixed waste paper monthly. The

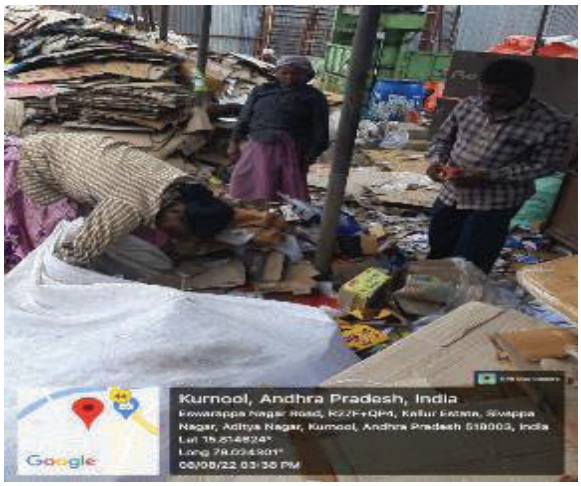


FIGURE 64: Bale analysis conducted at large-scale dealer, Kurnool

dealers received waste from residential, commercial and institutional areas of the city.

There were nearly 8 to 25 ragpickers supplying materials to each of these waste dealers. About 86% of the large scale dealers collected UBCs and accepted it along with mixed waste paper. Purchase price of mixed paper was indicated in range of ₹ 12/kg to ₹ 14/kg and a selling price ranged from ₹ 14/kg ₹ 16/kg. Majority of the UBCs were received through ragpickers and waste collectors and came from residential, commercial and institutional areas of Kurnool. Nearly 85% of the large scale dealers dealing with UBC reported that the UBCs were soiled, while 15% reported the pack being clean and ready for sale. None of the dealers were processing UBCs before selling.

Upon asking the fate of UBC, all the dealers claimed to be selling it along with mixed paper. Major discouragement of not collecting UBCs was no buyers in market.

They suggested that good price can definitely drive the UBCs recycling chain in Kurnool.

TABLE 51: Bale analysis of large scale dealer conducted in Kurnool

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Large-scale scrap dealers	57.1	0	0.000
	100	0.12	0.120
	60	0.573	0.955
	51	0.43	0.843
	60	0.58	0.967
	64.1	0.69	1.076
	72.7	0.72	0.990
Total	464.9	3.113	0.670

Dumpsite Analysis

The TERI team conducted the dumpsite analysis at Gargeyapuram landfill site. Three trucks containing waste from the residential, commercial, and institutional places of Kurnool city that arrived at the dumpsite were unloaded to conduct the analysis. The trucks contained mixed municipal waste coming from different parts of the city. From the mixed

FIGURE 65: Dumpsite analysis at Gargeyapuram landfill site, Kurnool

paper waste, UBCs were segregated. In about 9,477 kg of mixed waste, only 4.38 kg of UBC were found. This indicates that amounts of UBCs reaching the dumpsites are quite low.

TABLE 52: Dumpsite analysis conducted in Kurnool

Truck	Total truck load	Mixed paper waste	UBC found
Truck 1	1587 kg	160 kg	0.710 kg
Truck 2	3680 kg	368 kg	1.67 kg
Truck 3	4210 kg	410 kg	2 kg

Chennai

Waste Collectors

In Chennai 22 waste collectors were surveyed, who dealt with waste from residential, institutional, and commercial areas. These waste collectors collected all types of dry waste including plastics (100%), papers (100%), glass (81%), metal (81%), cardboard (90%), and Styrofoam (13%) for recycling. According to the survey, 86% of the waste collectors collected UBCs (all of them collecting it along with mixed paper waste), while the rest 13% avoided collecting UBCs due to lack of incentives. The average UBC collected by each of the dealers varied from 2 kg to 5 kg monthly, in nearly 20 kg to 100 kg of mixed paper waste. UBC was sold along with mixed paper waste in a price range of ₹ 5/kg to ₹ 10/kg, being higher in comparison to the study conducted in 2018.

The UBCs were procured by waste collectors from households (63%), street (22%), waste bins (5%), and markets (41%). The surveyed stakeholders mentioned that UBCs were predominantly coming from upper and middle income localities and commercial or business establishments 18%. Among the interviewed stakeholders, 49% of them reported that the UBCs reaching them were soiled while 51% reported them to be clean and ready for sale. When asked about the fate of the straws, 91% of the stakeholders mentioned that straws are found with the packs and are sold along with it as there is no individual market for straws.

The concerns of respondents for not collecting UBCs were:

- No separate market for UBCs
- Less money provided on UBC segregation and collection in comparison to mixed waste paper

Respondents suggested ways to improve UBC collection, which are as follows;

- A reasonable price should be offered
- There should be a proper market established for the collected UBC

Small-Scale Dealer

A total of 14 small scale dealers were interviewed in different areas of Chennai, each having an average collection of about 150 kg to 5000 kg of mixed waste paper every month. The stakeholders covered residential, institutional, and commercial areas. A large number of small scale dealers and ragpicker (10 – 35) were supplying materials to each of these waste dealers. As per the survey, 29% of the dealers collected

FIGURE 66: Small-scale dealer interviewed during survey, Chennai

UBCs along with mixed paper waste. However, UBC reached almost all the remaining waste dealers as well in Chennai. The purchase price of UBC has been indicated in the range of ₹ 2/kg to ₹ 3/kg whereas the price of mixed paper waste varied from ₹ INR 5/kg to ₹ 9/kg. The selling price of UBCs to larger dealers was about ₹ 2/kg to₹ 3/kg, while mixed paper waste varies from ₹ 7/kg to ₹ 12/kg. Dealers reported that majority of the UBCs come to them via ragpickers (43%), door to door collectors (43%), and commercial places (43%). Around 36% dealers reported that condition of UBCs as soiled, 14% reported that there is leftover juice content within the UBCs and 14% reported that the procured UBCs are clean and ready for sale. Upon asking the fate of UBC, 50% of the dealers sell it to the recycler and 29% dealers sell it further to the large scale dealers

Major concerns of dealers for not dealing with UBCs are:

- Low incentives
- Large scale dealers do not accept UBC, especially during the rainy seasons

The collection of UBC can be improved by offering good money for collection and segregation of UBCs and Recyclers accepting UBCs.

Large-Scale Dealer

In Chennai, seven large-scale scrap dealers were interviewed, who covered residential and commercial areas of the city. A large number of small scale dealers and ragpickers ranging from 45 to 65 were supplying materials to each of these waste dealers. In Chennai 100% of the large scale dealers collected UBC and all of them collected UBCs along with mixed paper. UBCs collected by each of these dealers monthly varied from 100 kg to 1500 kg. The selling price of UBCs and mixed paper was indicated in range of ₹ 5/kg to ₹ 6/kg and ₹ 7/kg to ₹ 8/kg respectively. The large scale dealers reported that UBCs were received majorly from door to door collectors (57%) and households

TABLE 53: Bale analysis done at small-scale dealers in Chennai

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Small -scale dealers	200	0.1	0.050
	100	0.2	0.200
	200	0.1	0.050
	200	0.3	0.150
	100	0.5	0.500
	100	0.2	0.200
	150	0.3	0.200
	250	0.5	0.200
	45	0	0.000
	150	0.1	0.067
	200	0.2	0.100
	150	0.4	0.267
	30	0	0.000
	200	0.2	0.100
Total	2075	3.1	0.149

FIGURE 67: Large-scale dealer interviewed during survey, Chennai

(57%). The dealers further reported that only 29% of the UBCs are soiled while the remaining 71% of the UBCs procured are clean and ready for sale. Upon asking the fate of UBCs, stakeholders mentioned 71% dealers sell further to larger dealers along with mixed waste paper; and 29% sell it to recyclers.

Major concerns of the large scale dealers in Chennai pertaining to UBCs were lesser incentives and lower prices. The dealers suggested that a higher price would result in better collection from ragpickers. Additionally, if major recyclers become willing to accept UBCs, the situation of UBC recycling chain in Chennai would improve considerably.

TABLE 54: Bale analysis done at large-scale dealers in Chennai

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Large-scale dealers	400	0.6	0.150
	387	0.7	0.181
	400	1	0.250
	400	0.5	0.125
	400	0.3	0.075
	300	0.5	0.167
	400	1	0.250
Total	2687	4.6	0.171

Dumpsite Analysis

Dumpsite analysis was done at Kodungaiyur dumpsite and covered three vehicles bringing in waste from different locations of Chennai. The details of the dumpsite analysis are tabulated below:

TABLE 55: Dumpsite analysis undertaken at Chennai

Truck details	Truck load	Mixed paper waste	UBC found
Truck 1	9750 kg	110 kg	2.8 kg
Truck 2	6300 kg	63 kg	5.5 kg
Truck 3	7350 kg	73.50 kg	2.5 kg

Ahmedabad

Waste Collectors

In Ahmedabad, 22 waste collectors were interviewed who were all ragpickers and were involved in collecting dry waste from across different areas including industrial (27%), commercial (86%) and residential (95%) areas. The dry waste collected for recycling includes paper (100%), plastics (100%), glass (36%), cardboard (100%) and metal (36%). The selling price of mixed paper waste was reported in the range of ₹ 6/kg to ₹ 10/kg. Approximately 4% of the ragpickers collected UBCs along with the mixed paper waste and further they sold it to small scale dealers with mixed paper as it offers them higher price. The UBCs collected are mostly in soiled condition as reported by the waste collectors.

The reasons as highlighted by the ragpickers for not dealing with the collection of UBCs are highlighted below:

- Due to less weight and value, UBCs have lesser price if collected separately in comparison to that of mixed paper waste
- Lack of awareness amongst the ragpickers for collection of UBCs
- More labour required for collecting of UBCs.

Small-scale Dealers

In Ahmedabad, 14 small scale dealers were surveyed. They were receiving waste from residential, commercial and institutional areas. There were around 3-14 ragpickers employed under them for the provision of material to dealers. Around 1500 kg to 8000 kg of mixed paper waste was collected by the small scale dealers in Ahmedabad monthly. The mixed paper purchase price was around ₹ 8/kg to ₹ 12/kg and the selling price was approximately in the range of ₹ 10/kg to ₹ 15/kg, higher than the 2018 study. All of the surveyed small scale dealers were dealing in the collection of UBC along with the mixed paper waste. The monthly average collection of UBC was reported in the range of 80 kg to 350 kg and was sold to large scale dealers and/or recyclers at a rate of around ₹ 8/kg to ₹ 11/kg, which is comparatively higher than the study conducted in 2018, though lesser than the price of mixed paper waste. The source of procurement of UBCs were mostly ragpickers, door -to door collectors and intermediate kabadiwallahs operating in institutional, residential and commercial areas. Nearly 63% of the respondents reported that the collected UBCs contained leftover juice within them, while the remaining 37% respondents claimed the collected packs to be and ready for sale.

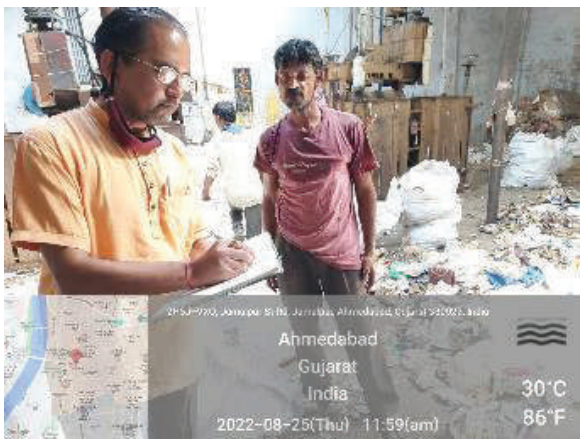


FIGURE 68: Small-scale dealer interviewed during survey, Ahmedabad

The reasons as highlighted by the small scale dealers in dealing with UBCs are discussed below:

- Less price due its low value and weight
- Lack of awareness
- Lack of buyers in the market
- Lack of manpower

In order to improve the collection of UBCs, the small scale dealers highlighted that along with increase in the awareness generation there should be increase in the price of UBCs similar to that of mixed paper waste as it will motivate the ragpickers and waste collectors to collect it separately. Also, clean material needs to be provided to them as the soiled condition of the UBCs give rise to foul smell at the facility and creates unsanitary working conditions.

TABLE 56: Small-scale dealer analysis in Ahmedabad

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC (%)
Small-scale waste dealers	318	0.5	0.157
	310	0.4	0.129
	321	1.5	0.467
	314	0.3	0.096
	410	0.7	0.171
	395	0.7	0.177
	428	1.1	0.257
	401	0.4	0.100
	355	0.6	0.169
	403	1.1	0.273
	380	2	0.395
	310	0.4	0.129
	385	0.77	0.200
	321	0.65	0.202
Total	5678	10.62	0.187

Large-scale Dealers

In Ahmedabad, 7 large-scale dealers were surveyed, who mainly dealt in collecting residential and commercial waste from malls, markets and theatres. There were approximately 8 to 80 ragpickers and intermediate kabadiwallahs providing material to them. The average amount of mixed paper waste collected was around 50,000 kg to 3,00,000 kg per month. They purchased mixed paper waste at a rate ranging from ₹ 8/kg to ₹ 10/kg and sold it to other recyclers or large scale dealers at an approximate rate of ₹ 10/kg to ₹ 25/kg. Approximately 57% of the large scale dealers accepted UBCs along with mixed paper waste from small scale dealers. The respondents were not collecting UBC separately due to the multi-layer packaging used in it which makes it difficult to recycle. Although, dealers engaged in the collection of UBC have increased since the previous study conducted in 2018 owing to an increase in the prices of mixed paper.

The reasons for not dealing with the UBC are highlighted as below:

» Lack of incentives

» Low in price and value

FIGURE 69: Large-scale dealer interviewed during survey, Ahmedabad

» Contamination of the UBCs gives rise to foul smell and is prone to insects and rodents thereby damaging the dry waste facility.

» Additional labour cost involved for segregating of UBCs.

As reported by the large scale dealers, in order to improve the collection of UBCs there should be proper source segregation, higher price incentive should be offered similar to that of plastics or cardboards and proper infrastructure should be instituted in order to store the UBCs.

TABLE 57: Large-scale dealer analysis in Ahmedabad

Category	Weight of Bale analysed (kg)	Weight of UBC found (kg)	% of UBC found
Large-scale Dealers	106.3	0	0.000
	390	1.8	0.462
	421	2	0.475
	350	0.239	0.068
	380	1.1	0.289
	50	0	0.000
	418	0.5	0.120
Total	2115.3	5.639	0.267

Dumpsite Analysis

The dumpsite analysis in Ahmedabad took place at Kankaria, Sherkota. Three trucks coming from commercial, residential and institutional areas were unloaded at the landfill site. These trucks included municipal solid waste from which mixed waste paper and UBC was segregated. At the dumpsite a total of 2,915 kg of waste was analysed wherein the mixed paper waste was found to be 4.11% of the total waste and the UBCs were 1.20% of the total mixed paper waste.

TABLE 58: Dumpsite analysis in Ahmedabad

Truck	Total truck load	Mixed Paper waste	Total UBC
Truck 1	1050 Kg	55 kg	0.2 kg
Truck 2	935 kg	18 kg	0.75 kg
Truck 3	930 kg	47 kg	0.5 kg

Lucknow

Waste Collectors

The waste collectors interviewed covered a mix of ragpickers (86%) and door to door waste collectors (14%) and majority of them reported to dealing in paper (100%), plastics (100%) glass (23%), metal scrap (32%) and cardboard (86%). All the surveyed waste collectors reported to be accepting UBC, along with mixed paper or cardboard. The waste collectors were collecting nearly 2 kg to 100 kg of UBC every month and selling them at a rate of about ₹ 5/kg to ₹ 7/kg. The mixed paper waste collection was much higher in the range of about 80 kg to 400 kg per month. The selling price of mixed paper waste was also higher at approximately ₹ 9/kg to ₹ 13/kg, which is higher in comparison with 2018 study. The source of procurement of UBCs was reported as households, streets, waste bins, markets and malls. UBCs were majorly procured from upper middle income group societies (80%), commercial establishments (55%) and offices (55%). Nearly 54% of the respondents reported the collected UBCs to be soiled, while 46% were reported as clean and ready for sale. On the fate of UBCs about 81% of the respondents reported to sell them to large dealers and the rest reported selling them along with mixed paper. On the reasons that discouraged them of not dealing with UBCs, almost 90% mentioned reason of not getting a good rate and the rest reported lack of the UBCs collection. All the respondents reported that getting a better deal from the dealers is what can drive them into collection and aid in better recycling of the UBCs.

Small-scale Dealers

In Lucknow, fourteen small scale dealers were interviewed and assessed, the number of ragpickers/ collectors contributing to each of them ranged from 3 to 25. These dealers primarily collected waste paper and the average waste paper collection reported by them was in the range of 800 kg to 8 tons every month. In comparison to the previous study conducted in 2018, there is an increase in the purchase and selling of mixed paper wherein the purchase price of mixed paper has been indicated in the range of ₹ 18/kg to ₹ 12/kg and the selling price ranged from ₹ 10/kg to ₹ 30/kg depending upon the quality of the paper. About 93% of the small scale dealers were accepting UBCs with mixed paper, while none of them were collecting it separately. The dealers who collected UBC along with mixed paper reported to have a collection of nearly 60 kg to 100 kg every month. UBCs are procured from households, door to door collectors, ragpickers, intermediate kabaddi, and even directly from hotels, malls and markets along with mixed paper. One respondent claimed that the price of UBC is lesser than that of mixed paper waste although the price has increased since 2018 and is purchased and sold at ₹ 5/kg and ₹ 7/kg respectively. However, there is no separate market for UBC in Lucknow at present. The collected UBCs contained

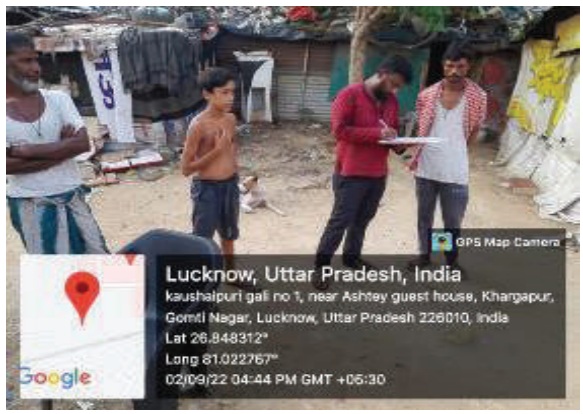


FIGURE 70: Small-scale dealer interviewed during survey, Lucknow

leftover fluids as reported by about 50% respondents, while 42% reported UBCs to be in clean and ready for sale condition. In regard to the fate of the UBCs about 92% of the dealers reported to selling them to the larger dealers.

The key imperatives discouraging waste dealers for dealing in UBCs separately were as follows:

- Lesser quantity of UBCs to deal in
- No buyers specific for UBCs
- Low rates from larger dealers
- Lack of knowledge among collectors and sellers on recyclability of UBC

The small scale dealers suggested that a good price and a competitive market for UBCs along with more awareness among various stakeholders can help start a good recycling for UBCs.

TABLE 59: Bale Analysis Conducted at Small-scale Dealers in Lucknow

Category	Weight of Bale Analyzed (kg)	UBC found (kg)	% of UBC
Small-scale Dealers	400	0.25	0.063
	217	2.4	1.106
	53	0.2	0.377
	250	2.1	0.840
	299.5	1.8	0.601
	234.5	1.5	0.640
	251.4	1.2	0.477
	251.3	1.7	0.676
	71	0	0.000
	234.9	1.5	0.639
	258.9	1.2	0.463
	307.05	2.4	0.782
	244.7	1.7	0.695
	249.9	1.6	0.640
Total	3323.15	19.55	0.588

Large-scale Dealers

Large-scale dealers accepted all types of solid waste from small-scale dealers and waste collectors throughout the city. 7 large scale waste dealers were interviewed in Lucknow. These dealers reported dealing with waste from residential, commercial and institutional areas. The quantity of mixed waste paper at these dealers ranged from 9000 kg to 1,00,000 kg per month and number of small scale dealers/ragpickers contributing to each of these dealer ranged from 8 to 60. The purchase price of mixed paper was indicated as ₹ 1/kg to ₹ 8/kg and the selling price as ₹ 3/kg to ₹ 25/kg. All of dealers were accepting UBCs along with mixed paper waste. The UBC received per month was in the range of about 2000 kg to 3000 kg. However, dealers indicated the purchase price of mixed paper with UBC being lower at around ₹ 4/kg and the selling price of the same being at ₹ 10/kg. Majority of the UBCs were procured from door-to-door collectors, ragpickers and small scale dealers. When asked on the condition of UBCs, about 71% stakeholders indicated that UBCs received were soiled, while 29% were clean and ready for sale.

FIGURE 71: Large scale dealer interviewed during survey, Lucknow

About 43% of the dealers reported that they did not process the UBCs before sale and 14% of them specified they bail and sell them. In regard to the fate of the UBCs all the dealers mentioned they would sell them to larger dealers and few reported they also sell them to recyclers.

When asked on the discouragements for not segregating and selling UBCs the dealers reported following aspects:

- There is no buyer specific to UBCs and hence goes with mixed paper
- Segregating UBCs will take time and hence there will be no incentive in UBC business
- Low quantity of UBCs (turnover)
- Low price and low level of segregation demotivates specific UBC business

TABLE 60: Large-scale dealer analysis in Lucknow

Category	Weight of Bale Analyzed (kg)	UBC found (kg)	% of UBC
Large-scale dealers	341.6	3.7	1.083
	356	2.4	0.674
	334	2.9	0.868
	337	8.7	2.582
	290.3	3.7	1.275
	281.5	2.05	0.728
	319.6	2.5	0.782
Total	2260	25.95	1.148

Dumpsite Analysis

Dumpsite analysis was done at Mohan road dumpsite in Lucknow and analysed three vehicles bringing waste from different commercial, institutional and residential locations of the city. The outputs of the analysis are as under table below

TABLE 61: Dumpsite analysis in Lucknow

Truck	Total Waste	Mixed Paper Waste	UBC found
Truck 1	8300 kg	76 kg	5.7 kg
Truck 2	10,650 kg	93 kg	7.1 kg
Truck 3	9226 kg	63 kg	4.2 kg

Mumbai

Waste Collectors

Twenty two waste collectors were surveyed during the course of study wherein 38% of the waste collectors were ragpickers and the remaining 62% were door to door waste collectors. The waste collectors were involved in the collection of dry waste including paper (100%), plastics (100%), glass (41%), metals (18%), cardboard (100%), etc. All the waste collectors were involved in the collection of UBCs along with mixed paper waste and sold it further to the small or large-scale dealers. The surveyed respondents were collecting waste either on behalf of the small and large-scale vendors, or independently selling their collected waste to kabadiwallahs to make their ends meet.

The mixed paper waste collection varied from 150 kg to 800 kg monthly (including UBCs) and was sold in the range of ₹ 5/kg to ₹ 10/kg. The average monthly UBCs collected by the waste collectors varied from 5 kg to 45 kg. Unlike the study conducted in 2018, wherein there was no selling price for UBC, the average selling price of the UBCs ranged between ₹ 4/kg to ₹ 5/kg. The source of procurement of UBCs were mainly from residential areas (particularly upper and middle class societies), community bins, street waste and markets.

The reasons as highlighted by the waste collectors for not dealing with UBCs were:

- The soiled conditions of the UBCs, make the dry waste facility prone to insects and rodents attacks

which is why many waste aggregators did not accept UBC

» Lack of storage space

» Lack of buyers in the market

» Lack of awareness

In order to improve the collection, the UBCs, the waste collector suggested that there should segregation of waste at source along with the increase in the selling prices of UBC similar to that duplex paper or cardboard. In addition to this, there should be a dedicated market for UBCs, wherein the waste dealers are willing to take it separately.

Small-scale Dealers

Fourteen small-scale dealers were surveyed across the city of Mumbai. The small-scale dealers in Mumbai mainly indulge in collecting waste from residential, institutional and other commercial establishments like cinemas, stadiums, etc. The small scale dealers also receive waste from around 5 to 20 intermediate kabadiwallahs and/or ragpickers. The total average mixed waste collected per month varied from 3000 kg to 15,000 kg. The purchase price of mixed paper waste was in the range of around ₹ 4/kg to ₹ 6/kg and the selling price was estimated to be around ₹ 8/kg to ₹ 10/kg. About 64% of the dealers were engaged in the collection of UBC along with the mixed paper whereas remaining does not collect UBC due to its low price and lack of incentives. The average UBCs collected per month (along with mixed paper waste) at the small scale dealer level was in the range of 800 kg to 1000 kg and was further sold along with duplex paper waste for roughly ₹ 7/kg to ₹ 9/kg to the large scale dealers or recycler.

FIGURE 72: Small-scale dealer analysis in Mumbai

One of the respondents highlighted that the presence of UBC majorly depends on the waste generator. For instance, UBC presence is relatively higher in High-Income Group societies (HIG), and also in commercial establishments. Of the surveyed stakeholders, 40% of the waste dealers did not process or treat UBC waste before selling it to the large scale dealers while the remaining bailed UBC along with mixed paper waste.

The reasons as highlighted by the small-scale dealers for not dealing with the UBCs are discussed as below:

» Lack of awareness

» Low price in comparison to mixed paper waste

» Lack of buyers in the market

» Require high storage area and are prone to rats and rodents attack

In order to maximize efficiency of the UBC collection, the respondents suggested that there should be increase in the price of the UBC similar to that cardboards or duplex paper and segregation at source should be increased. Waste dealers also suggested that the collection of UBC can be improved if there are more collection centres for UBC wherein people can drop their UBC and large quantity would be collected so they can further sell it in market.

TABLE 62: Small-scale dealer analysis in Mumbai

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Small-scale Dealers	86	2.5	2.907
	82	0	0.000
	35	0	0.000
	75	2	2.667
	110	4	3.636
	90	1	1.111
	280	16	5.714
	180	10	5.556
	310	33	10.645
	61	0	0.000
	94	0	0.000
	150	5	3.333
	47	0	0.000
	130	6	4.615
Total	1730	79.5	4.595

Large-scale Dealers

Seven large-scale dealers were surveyed across the city wherein the dealers were dealing mainly with waste from commercial and residential areas. The large scale dealers purchased waste from several small scale dealers depending and also employed almost 7 to 55 ragpickers. The total mixed paper waste collected per month at these large scale dealer level varied from 55,000 kg to 1,50,000 kg per month which is purchased at a rate of ₹ 5/kg to ₹ 10/kg and sold at a rate of ₹ 9/kg to ₹ 15/kg. About 71% of the large scale dealers accepted UBCs and the total quantum received as part of mixed paper waste at these large scale dealers facilities varied from 3000 kg to 20,000 kg per month and was further sold at a rate in the range of ₹ 7/kg to ₹ 11/kg, which being higher in comparison to of 2018 study. It was highlighted during the survey that mixed paper waste

FIGURE 73: Large-scale dealer analysis in Mumbai

dealing was hampered during the rainy seasons since its value drops. The major sources of procurement of UBCs were from residential areas, commercial areas and door to door waste collectors. The stakeholders mentioned that around 70% of them received UBCs along with mixed paper waste and further sold it to other large scale dealers or to a paper mill in Pune or Navi Mumbai while the remaining 30% do not deal with the UBCs.

The reasons highlighted by large scale dealers for not dealing with UBCs are highlighted below:

- Market unavailability
- Soiled condition of the UBCs contaminates the dry waste facility
- Lack of buyers in the market

In order to maximize the collection of UBCs, the large scale dealers highlighted there should be a formal channel for collection of UBCs such as designated

collection centres in the city and segregation of the waste at source level should be encouraged.

The analysed large scale dealers in Mumbai are as follows:

TABLE 63: Large-scale dealer analysis in Mumbai

Category	Weight of bale analysed (kg)	Weight of UBC found (in kg)	% of UBC found
Large-scale Dealers	340	17	5.000
	260	10	3.846
	120	0	0.000
	186	0	0.000
	97	0	0.000
	104	0	0.000
	220	12	5.455
Total	1327	39	2.939

Dumpsite analysis

The dumpsite analysis in Mumbai city was undertaken at Mahalaxmi waste transfer station located in South Mumbai. It was observed that due to the rainy season, a lot of mixed paper waste was arriving at the dumping facility since dealers were not accepting it. A total of three trucks from commercial, residential and institutional areas were analysed.

TABLE 64: Dumpsite analysis in Mumbai

Truck	Total truck load	Mixed paper waste	UBC found
Truck 1	2480 kg	17 kg	2 kg
Truck 2	2780 kg	23 kg	3.5 kg
Truck 3	2500 kg	12 kg	1.1 kg

Pune

Waste Collectors

In Pune city twenty-two waste collectors were surveyed across the city wherein 95% of the waste collectors were ragpickers and the remaining 5% were door to door waste collectors, both covering residential and commercial areas. The waste collectors were involved in the collection of paper (100%), plastics (100%), glass (68%), metal (64%), and cardboards (100%), etc. for recycling. Unlike the study conducted in 2018, all the waste collectors were involved in the collection of UBCs along with the mixed paper waste owing to higher prices. The average UBC collected per month varied from 30 kg to 100 kg per month and were sold along with mixed paper waste at ₹ 6/kg to ₹ 10/kg. The source of procurement of UBCs was largely from residential areas of middle income localities. The waste collectors and ragpickers dealing with UBC were usually employed by the large and small-scale dealers. These waste collectors sell UBC along with mixed paper waste (duplex paper) to the dealers as the individual value of UBC is very low in comparison with cardboard and duplex paper.

The reason as highlighted by the surveyed waste collectors for not dealing with the UBC are mentioned as below:

- Lack of monetary incentive
- Low value and weight
- More labour will be required for segregation

In order to further improve the UBC collection, waste collectors suggested that there should be a higher incentive for UBC collection similar or equivalent to that of plastics and also there should be a proper market for purchase of UBCs separately

Small-Scale Waste Dealers

Fourteen small scale waste dealers were surveyed across the city who were dealing with waste from residential areas, commercial areas such as hotels and also collected waste from large number of ragpickers and door to door waste collectors approximately in the range of 8 to 30. The average

FIGURE 74: Small-scale dealer interviewed during survey, Pune

monthly mixed paper waste collected at these waste dealers level varied from 2500 kg to 15,000 kg per month. The purchase price of mixed paper waste was in the range of ₹ 5/kg to ₹ 8/kg whereas the selling price was approximately ₹ 10/kg to ₹ 13/kg. All the dealers reported to collected UBC along with the mixed paper. The average UBC collected per month was around 80 kg to 350 kg and was sold to large scale dealers at the rate of ₹ 8/kg to ₹ 12/kg (usually along with mixed paper waste). Unlike the study conducted in 2018, there is an increase in the per kg selling and purchase price of UBC and mixed paper respectively. The UBCs collected are mostly in clean condition (79%), while remaining reported that the UBCs received at their level were mostly soiled (21%).

The reasons as highlighted by the small scale dealers regarding the collection of UBCs are as follow:

- Lack of demand
- Low price and lack of storage space to keep UBCs.
- Soiled condition and its storage becomes prone to rats, insects, etc. thereby hampering the entire dry waste facility
- Lack of segregation at the source level

In order to maximize the collection efficiency of UBCs it was suggested that there should be higher incentive and frequent collection of UBCs by the large scale dealers for recycling.

TABLE 65: Small-scale dealer analysis in Pune

Category	Weight of bale analysed (kg)	UBC found in bale (kg)	Percentage of UBC
Small-scale Dealers	183	19.5	10.656
	150	2	1.333
	117.9	3.3	2.799
	113	0.4	0.354
	128	0.8	0.625
	165	1.2	0.727
	180	0.6	0.333
	135	0.7	0.519
	155	0.4	0.258
	130	0.8	0.615
	210	1	0.524
	170	1.1	0.647
	127	0.65	0.512
	148	0.7	0.473
Total	2111.9	33.25	1.574

Large-scale Waste Dealers

Seven large scale dealers were surveyed across the city who were dealing with waste from residential, institutional and commercial areas as well as from around 8 to 80 ragpickers and small scale dealers. Around 57% of the large scale dealers were involved in

FIGURE 75: Large-scale dealer interviewed during survey, Pune

the collection of UBCs along with mixed paper waste, 14% were collecting segregated UBC from a few small and large scale dealers, while the remaining 29% were not accepting UBC (however received along with mixed paper waste). The average mixed paper waste collected per month at these large scale dealers varied from 30,000 kg to 1,00,000 kg at a rate of ₹ 8/kg to ₹ 12/kg and was sold at a rate ranging from ₹ 10/kg to ₹ 25/kg. The average UBC collected per month varied from 250 kg to 4500 kg and the selling price was in the range of ₹ 10/kg to ₹ 12/kg, while it was purchased by one of the dealers separately at ₹ 5/kg to ₹ 8/kg. The major source of procurement of UBC are from intermediate waste dealers (62%) and commercial areas (28%). The condition of the UBCs collected are mostly soiled and found with straws inside the pack only. The large scale dealers do not process or treat UBCs at their facility however, it was observed that around 14% of the large scale dealers emptied the UBC and then sell it to other large scale dealers along with the mixed paper waste. One of the surveyed large scale dealer receives UBC waste from several large and small scale dealers and sells it to paper mill.

The reasons as highlighted by the large scale dealers for not dealing with the UBCs are discussed below:

- Lack of proper organized market for UBCs
- Lack of incentive for collecting UBCs
- Low volume and weight
- Additional cost of segregation

The stakeholders suggested that in order to improve the collection of UBCs, they would need a market for the recyclables with the price of UBCs equivalent to that of cardboard or plastics and also incentivize the waste collectors at small scale. Also, there needs to be strong network of logistics so that the collected UBCs can be picked up frequently, as storage of mostly soiled UBCs in the dry facility is a risk and one of the primary concerns of small and large-scale dealers for not dealing with UBC.

TABLE 66: Large-scale dealer analysis in Pune

Category	Weight of the bale analysed (kg)	Weight of UBCs found (kg)	% of UBC
Large-scale Dealers	407	4.61	1.133
	410	3.5	0.854
	220	5.65	2.568
	250	0.9	0.360
	350	3.2	0.914
	135.7	0.9	0.663
	402	19	4.726
Total	2174.7	37.76	1.736

Dumpsite Analysis

The Pune city does not have a dumpsite, it has a temporary storage facilities/material recovery stations. The Pune Municipal Corporation (PMC), material recovery facility at Indira Nagar was visited. The waste reaching the material recovery facility

FIGURE 76: Dumpsite Analysis at Indira Nagar, Pune

TABLE 67: Dumpsite analysis in Pune

Truck	Total truck load	Mixed paper waste	UBC found
Truck 1	835 kg	21 kg	0.15 kg
Truck 2	600 kg	24 kg	0.1 kg
Truck 3	1275 kg	42.7 kg	0.3kg

firstly moves to a trommel wherein the dust particles are removed and further it is moved over a conveyor belt and gets sorted into different categories such as plastics, cloth, glass, paper, cardboard, packaging material, metal and non-recyclables. Three trucks comprising of the municipal solid waste were analysed at the facility. The mixed paper waste and the UBCs were weighted. There is no separate segregation of the UBC before reaching the facility and it is collected along with mixed paper waste and sold to either small- or large-scale dealers.

Paper Mills Surveyed

The summary of the 10 paper mills surveyed under this project are as follows:

TABLE 68: Paper mills visit summary

No.	Name of the Paper Mill	City	Do you get UBCs with mixed paper waste	Truck load	UBCs found in kg	Per kg purchase price of UBC (₹)
1.	Ecotech Papers	Guwahati	Yes	420 kg	0.25 kg	Along with mixed paper
2.	Balaji Malts Pvt. Ltd.	Bengaluru	Yes	8000 kg	250 kg	10.0
3.	Rajshil Papers Pvt Ltd	Mysuru	No	5000 kg	-	-
4.	Khandagiri Pulp Pvt Ltd	Bhubaneshwar	No	3000 kg	-	-
5.	Raja Board and Paper Mill	Kolkata	Yes	2000 kg	5 kg	Along with mixed paper
6.	Nicer Paper Mill	Jammu	No	8000 kg	-	-
7.	ITC Paper Mill	Coimbatore	Yes	10,000 kg	13 kg	14.0
8.	Nikita Paper Mill	Shamli	No	15,000 kg	-	-
9.	New Balaji Paper Mill	Pune	No	800 kg	-	-
10.	Khatima Paper Mill	Khatima	Yes	15,000 kg of UBC in truck	13.0-22.5	

Ten paper mills were surveyed in 10 different Indian cities and it was found that nearly 50% of the paper mills were dealing with UBCs for creating pulp as they have better technologies. The remaining mills were not accepting UBCs owing to its multi-layer packaging which takes a higher time to generate pulp and also leads to the settling of plastic layer at the bottom of the pulper. This was mostly witnessed in the smaller paper mills that use rudimentary methods for creating pulp and paper.

The total mixed paper waste collected and processed at the paper mill varied from 200 kg per month to 10,000 kg per month. The amount of UBCs found at the paper mills varied from 0.25 kg to 15,000 kg per truck reaching the facility. The mixed paper waste along with the UBCs are procured from residential, commercial and institutional areas. The purchase price of the mixed paper waste varied from ₹ 13/kg to ₹ 22.5/kg.

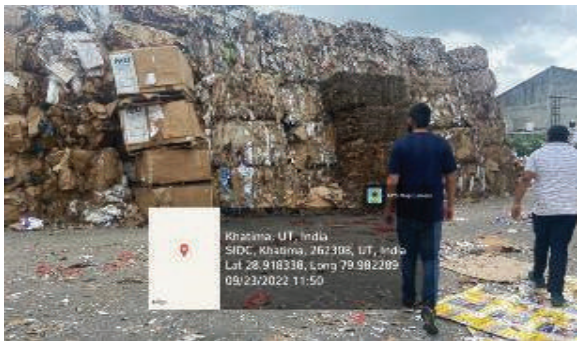


FIGURE 77: Khatima Paper Mill, Uttarakhand

The mills have been involved in manufacturing of white paper, kraft paper, floating media paper, moulded paper tray and grey boards.

As indicated at the paper mill by the respondents, the fate of the rejected material

FIGURE 78: Rajshil Paper Mill, Mysuru, Karnataka

- Goes to secondary manufactures
- Used in processing facilities such as cement kilns
- Get disposed along with the general waste

The issues mentioned by the respondents for not dealing with UBC separately are highlighted as below:

- Processing of UBCs is time consuming and labour expensive
- Quantity received is very less and is generally disposed off
- The contaminated nature of the UBCs, affects the grade quality of the manufacturing product as well hampers their machineries
- Lack of advanced technology increases the time for pulping of UBCs, thereby affecting productivity

In order to maximize the collection of UBCs, the respondents suggested:

- Awareness generation and segregation of UBCs at the source level, as it helps to maintain the quality of collected UBC
- Advancement in technology and infrastructure
- Clean materials should be provided to paper mill as the contaminated stock affects the grade quality of paper.

FIGURE 79: Raja Board and Paper Mill, Kolkata

UBC Management Chain

Figure below shows the schematic representation of dry waste management system in India.

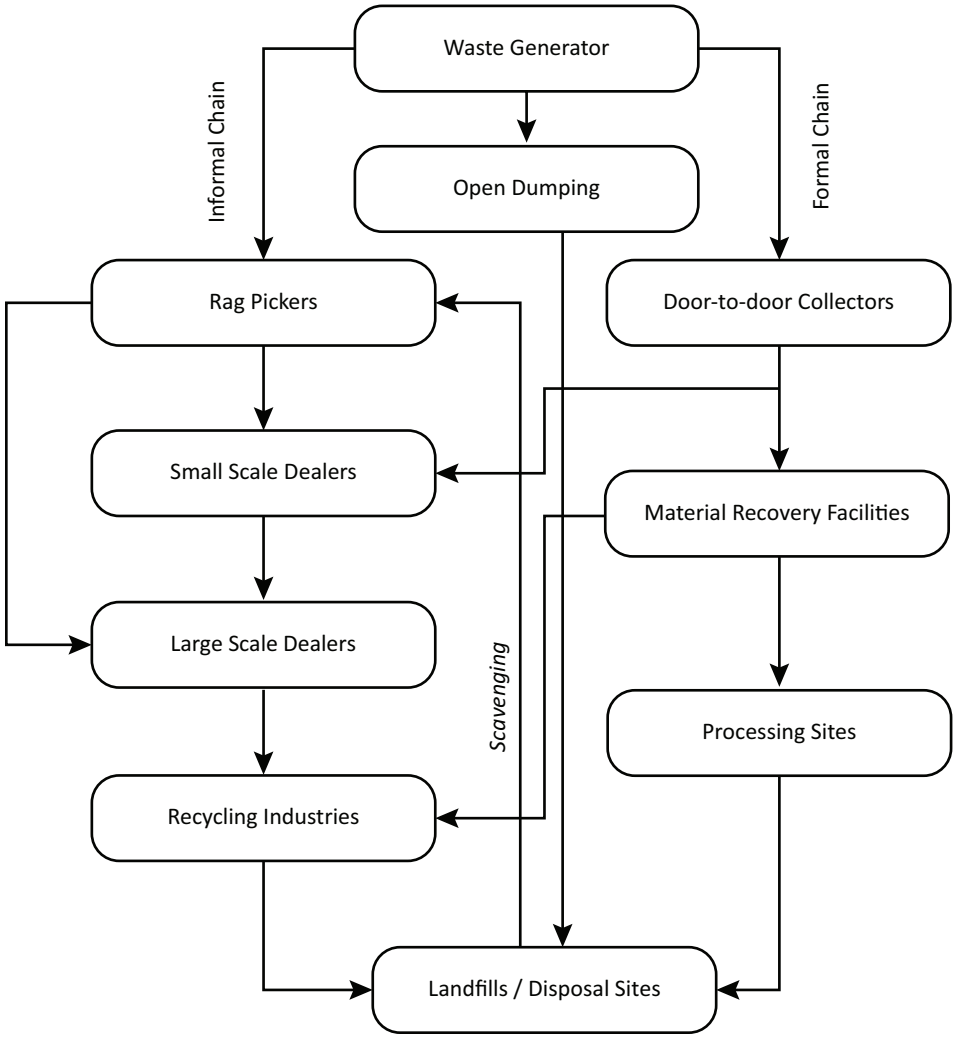


FIGURE 80: Dry waste management chain in India

The fate of UBCs varies from city to city since there are different collection and recycling systems. While in some cities like Bhubaneswar and Srinagar, UBCs are not at all collected by the informal sector, some have a more seasonal consumption and market as witnessed in Nagpur and Kurnool, and some cities like Delhi and Faridabad have very high UBC collection and recycling rates. Awareness level and availability of markets via recycling units, decides the fate of UBCs. For cities that recycle UBCs have the following stakeholder involvement:

- **Street waste picking**: UBCs are recovered from mixed waste found on streets or extracted from community bins ragpickers. This practice probably occurs in most of the cities where UBCs are accepted by waste dealers.
- **Door to door waste collection**: UBCs are recovered along with other waste from vehicles transporting waste to dhalao/community bin sites. This practice is widespread in almost all cities where door-to-door collection is practiced.
- **Hotels and institutions**: Waste collected from airports, canteens, and hotels are sorted for UBCs and further sold to small or/and large dealers for recycling.
- **Waste picking from dumps**: Waste pickers/ scavengers sort through waste before it is sent to the site for final disposal. Sorting is often carried out by communities that live on or near the dump.

The UBC waste recycling chain begins through waste pickers collecting waste from streets, waste bins, households (generators) and dumpsites and selling it to kabadiwalas or small-scale waste dealers, who provide immediate monetary return for the recyclables. Similarly, door-to-door collectors segregate recyclables at the very first stage. The collected waste is sorted and sold to small-scale waste dealers or kabadiwalas.

Kabadiwalas store the small quantities of waste contributed to them by door-to-door collectors, ragpickers, and directly from waste generators at their level. After collecting an economically viable quantity of recyclable wastes, they sell these to large-scale dealers nearby. The dealers provide immediate monetary value for the waste and sometimes even pay in advance to retain their suppliers. These dealers further sell their waste to large scale dealers once they have collected a considerable amount of recyclable waste. However, in the case of UBCs, many small scale dealers find it challenging to store them for a longer time (nearly 10-15 days until it can be sold to the large scale dealers) due to contamination from the organic contents remaining in the UBC.

Dealers further categorize waste as per the grade of paper/waste for fetching maximum monetary value. They either directly sell it to the paper mills or sell it to the wholesalers depending on the terms of payment and price offered.

Recycling units purchase segregated waste to prepare various products such as Kraft, floating media paper, molded pulp tray etc. Through consistent interventions over the past 18 years, Tetra Pak has successfully managed to reinforce paper based cartons, a lucrative raw material for paper mills and recyclers. Tetra Pak has roped in multiple agencies that are engaged in collecting segregated UBCs from ragpickers and kabadiwalas in various cities across different regions of the country. Once they collect sufficient quantities, these agencies supply UBCs to paper mills. Such agencies are contributing in active recycling of UBCs and have also been reported in analysis of recycling rates of UBCs. This helps in reducing the carbon footprints as well as create jobs in our country.

Waste pulp and paper chain

According to some estimates, one tonne of recycled paper saves approximately 17 trees, 2.5 barrels of oil, 4100 Kilowatt hours of electricity, 4 cubic meters of landfill and 31,780 litres of water. In other words, it has been estimated that recycling one tonne of waste paper results in saving of 70% raw material, 60% coal, 43% energy and 70% water, as compared to making virgin paper from wood.[4]

Today, there are about 900 pulp and paper mills in the country producing a range of paper varieties. Nearly 76% of the paper produced in India uses waste paper or recycled cellulose fibre (RCF) as the primary raw material and the operational production of these papers is nearly 16.3 million in 2021.[5] RCF is best suited as a raw material for end products like newsprint, duplex board and kraft paper.

[4] https://dpiit.gov.in/sites/default/files/DiscussionPaper_Recycling_WastePaper_21October2011%20%208.pdf

[5] https://cppri.res.in/sites/default/files/annual%20report%20%2820-21%29%20english.pdf

TABLE 69: Waste management scenario in surveyed cities

S.No	City Name	Waste Generation (TPD)	% Paper in MSW	ULB Collection Rate
1	Delhi	10990[6]	5.6[7]	100%
2	Faridabad	850[8]	5.6	94%
3	Lucknow	1365[9]	15[10]	93%
4	Srinagar	520[11]	15.2	100%
5	Jammu	434[12]	10.38	100%
6	Kolkata	4500[13]	6.07	90%
7	Guwahati	550[14]	14[15]	100%
8	Ahmedabad	3300[16]	4	100%
9	Mumbai	6533[17]	7.52	98.85%
10	Pune	1900[18]	8	100%
11	Kochi	317[19]	5[20]	89.8%
12	Bengaluru	6100[21]	28	95%
13	Chennai	4593[22]	8.38[23]	97%
14	Mysuru	450[24]	7.77	100%
15	Bhubaneswar	520[25]	8	100%
16	Thiruvananthapuram	448[26]	4.78	90%
17	Nagpur	1014[27]	5	100%
18	Chandigarh	513[28]	6[29]	100%
19	Shimla	82[30]	20.03	87.5%
20	Dharamshala	15[31]	20.03	93.33%
21	Kurnool	250	9.7	100%
22	Hyderabad	6098[32]	7.26	100%

6 https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2020-21.pdf
7 Kumar,A,. (2016). Existing situation of MSW in NCT of Delhi, India. International Journal of social sciences. (Vol 1, (1), pp 6-17. http://ijss.publicationsupport.com/docs/paper/Volume-1/issue_1/IJSS-104.pdf
8 http://harenvironment.gov.in/sites/default/files/2017-02/Faridabad%20DEP.pdf
9 https://www.irjet.net/archives/V9/i3/IRJET-V9I3270.pdf
10 https://www.ijser.org/researchpaper/Solid-Waste-Management-and-Characteristics-in-Lucknow-Uttar-Pradesh-India.pdf
11 http://jkspcb.nic.in/WriteReadData/userfiles/file/MSW/Annual%20Report%20of%20MSW%202021-22001.pdf
12 http://jkspcb.nic.in/WriteReadData/userfiles/file/MSW/Annual%20Report%20of%20MSW%202021-22001.pdf
13 https://www.wbpcb.gov.in/files/Mo-12-2021-12-34-40SEP.pdf
14 https://gmc.assam.gov.in/information-services/conservancy
15 https://www.researchgate.net/publication/322538071_Municipal_Solid_Waste_Management_in_Guwahati_City_India
16 https://gpcb.gujarat.gov.in/uploads/AR_2020_21_ENGLISH.pdf
17 https://mpcb.gov.in/sites/default/files/solid-waste/SWMFInalAnnualReport202030072021.pdf
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21 https://www.niti.gov.in/sites/default/files/2021-12/Waste-Wise-Cities.pdf
22 https://tnpcb.gov.in/pdf_2021/AnnualRptSolidwaste2021.pdf
23 http://www.cmdachennai.gov.in/Volume3_English_PDF/Vol3_Chapter09_Soild%20Waste%20Management.pdf
24 https://www.niti.gov.in/sites/default/files/2021-12/Waste-Wise-Cities.pdf
25 https://mpcb.gov.in/sites/default/files/solid-waste/SWMFInalAnnualReport202030072021.pdf
26 https://www.keralapcb.nic.in/cmsadmin/fileUploads/SWM%20ANNUAL%20REPORT%20FINAL%202020-21.pdf
27 https://mpcb.gov.in/sites/default/files/solid-waste/SWMFInalAnnualReport202030072021.pdf
28 https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2020-21.pdf
29 Assessment of Solid Waste.pdf (hpccc.gov.in)
30 http://hppcb.nic.in/Publications/SW-AR-2020-21.pdf
31 http://hppcb.nic.in/Publications/SW-AR-2020-21.pdf
32 http://www.indiaenvironmentportal.org.in/files/file/waste-management-Telangana-report-NGT-2021.pdf

According to the Ministry of Housing and Urban Affairs (MoHUA), in 2021 roughly 7% of MSW consisted of paper and cardboard waste with an estimated recovery rate of 60%. The quantity of paper and cardboard which was recovered in 2021 was 2,222,850 tonnes,[33] which corresponds to nearly 57% recovery. Hence the paper recovery rate for waste paper in India is assumed at 57% for calculations within this report.

With this being mentioned, table below is a compilation of extensive secondary research in order to estimate the waste paper being generated in the 22 cities for better understanding the UBC recycling potential of the surveyed cities.

Economic Analysis

As a part of the survey, the market value of UBCs and mixed paper was identified to analyse the value chain. The table below presents the range of selling price of UBC per kg as reported by stakeholders involved across the value chain in the surveyed cities.

TABLE 70: Economic analysis of the UBC value chain

Cities	Waste collectors (₹/kg)	Small-scale waste dealers (₹/kg)	Large-scale waste dealers (₹/kg)
Delhi	6.0 - 8.0	7.0 - 8.0	8.0 - 18.0
Srinagar	6.0*	8.0 – 24.0*	5.0 – 15.0
Guwahati	2.0 - 12.0	3.0 - 8.0	5.0 - 30.0*
Jammu	4.0	5.0 – 10.0	6.0
Faridabad	6.0 - 10.0	8.0 - 12.0*	6.0
Dharamshala	-	-	-
Shimla	-	-	15.0 - 18.0*
Kolkata	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Bhubaneswar	-	-	-
Chandigarh	3.0 - 5.0*	7.0 - 15.0*	6.0 - 7.0
Thiruvananthapuram	1.0 - 3.0	1.0 - 3.0	10.0 - 18.0*
Kochi	1.0 - 2.0	1.0 - 3.0	3.0 - 7.0
Mysuru	4.0 - 6.0	8.0 - 25.0*	13.0 - 15.0
Bengaluru	6.0 - 7.0	8.0 - 12.0	10.0 - 15.0*
Hyderabad	2.0 - 5.0	2.0 - 10.0	3.0 - 9.0
Nagpur	-	-	-
Kurnool	10.0 - 16.0*	12.0 - 30.0*	14.0 - 16.0*
Chennai	5.0 - 10.0*	2.0 - 3.0	5.0 - 6.0
Ahmedabad	6.0 - 10.0*	8.0 - 11.0*	10.0 - 25.0*
Lucknow	5.0 - 7.0	7.0	10.0
Mumbai	4.0 - 5.0	7.0 - 9.0*	7.0 - 11.0
Pune	6.0 - 10.0*	8.0 - 12.0*	10.0 - 12.0

*Goes along with mixed paper waste

[33] https://mohua.gov.in/upload/whatsnew/627b833ecac62Circular-Economy-in-waste-management-FINAL.pdf

Survey Analysis

A breakdown of the field survey has been tabulated in this segment. The first is the fraction of the dealers accepting UBC along with the total percentage of the UBC found with small and large scale dealers in each of the 22 cities.

Considering the fraction of waste paper analyzed being around 50% of paper and cardboard market share, the quantity of waste generated in each city, the fraction of paper waste being generated and the percentage of waste collected by informal sector for recycling; the informal recycling rates have been established. Also it is important to note that the average weight of a beverage carton is 7.5-8 grams (Tetra Pak).

The informal recycling rates for Indian cities are given in Table 72.

TABLE 71: Fraction of dealers (small and large) accepting UBC in surveyed cities and the average percentage of UBC found at dealer level in each city

Fraction of UBCs in Paper Waste									
City	Small-scale				Large-scale				
	Fraction of dealers accepting UBC	% UBC	Total load analyzed (kg)	Total UBC found (kg)	Fraction of dealers accepting UBC	% UBC	Total load analyzed (kg)	Total UBC found (kg)	Average % UBC
Bhubaneswar	0.00	0.00	474.00	0.00	0.00	0.00	220.00	0.00	0.00
Kurnool	0.86	0.29	1885.62	5.44	0.86	0.67	464.90	3.11	0.36
Thiruvananthapuram	0.29	0.07	5343.92	3.91	0.33	0.42	2264.00	9.61	0.18
Kochi	0.50	0.30	4546.50	13.51	1.00	0.48	2730.70	13.18	0.37
Chandigarh	1.00	0.82	620.98	5.08	1.00	3.26	1301.60	42.43	2.47
Shimla	0.00	0.03	371.61	0.10	1.00	2.30	915.00	21.05	1.64
Nagpur	0.00	0.00	1524.03	0.00	0.00	0.00	2015.40	0.00	0.00
Dharamshala	0.08	0.33	734.00	2.40	0.20	1.82	604.64	11.00	1.00
Srinagar	0.67	0.77	804.03	6.16	0.14	0.46	655.00	3.00	0.63
Jammu	0.36	0.34	997.35	3.35	0.14	0.30	758.05	2.29	0.32
Delhi	1.00	1.12	3851.00	43.27	1.00	1.30	2535.00	32.85	1.19
Mysuru	0.79	2.72	3271.93	89.03	0.80	1.72	2142.31	36.90	2.33
Bengaluru	0.93	1.71	3804.06	65.10	0.86	2.01	3130.35	62.81	1.84
Faridabad	0.71	0.68	3879.00	26.36	0.86	2.38	1694.20	40.35	1.20
Lucknow	0.93	0.59	3323.15	19.55	1.00	1.15	2260.00	25.95	0.81
Ahmedabad	1.00	0.21	5051.00	10.62	0.57	0.27	2115.30	5.64	0.23
Pune	1.00	1.57	2111.90	33.25	1.00	1.74	2174.70	37.76	1.66
Kolkata	0.86	0.97	1862.60	18.02	1.00	0.75	2077.00	15.66	0.85
Chennai	0.29	0.15	2075.00	3.10	1.00	0.17	2687.00	4.60	0.16
Mumbai	0.64	4.60	1730.00	79.50	0.43	2.94	1327.00	39.00	3.88
Guwahati	0.73	0.85	3540.00	30.03	0.50	0.70	1228.00	8.60	0.81
Hyderabad	0.93	1.79	5949.00	106.25	1.00	1.87	3114.00	58.25	1.82

TABLE 72: TetraPak UBC recycling rates in Indian cities

City	Consumption of UBC in TPA (2021)	Total MSW generated TPD	% paper waste in MSW	Total paper waste generated (TPA)	Fraction of UBC in paper waste (as per analysis)	Fraction of Dealers of UBC	Waste paper recovery (57%)	Fraction assumed for UBC waste as per analysis	UBC collected by informal sector (inactive recycling)	Active recycling (TPA)	Total recycling
Bhubaneswar	55.29	520	8%	15184	0.00000	0.00	8655	0.5	0	0	0
Kurnool	218.1	250	9.70%	8851.25	0.00350	0.86	5045	0.5	8	0	8
Trivandrum	70.45	448	4.78%	7816.256	0.00178	0.30	4455	0.5	1	0	1
Kochi	69.61	317	5%	5785.25	0.00367	0.67	3298	0.5	4	0	4
Chandigarh	121.07	513	6%	11234.7	0.02471	1.00	6404	0.5	79	34	113
Shimla	340.15	82	20.03%	5994.979	0.01644	0.25	3417	0.5	7	2	9
Nagpur	213.66	1014	5%	18505.5	0.00000	0.00	10548	0.5	0	0	0
Dharamshala	54.42	15	20.03%	1096.6425	0.01001	0.12	625	0.5	0	0	0
Srinagar	398.65	520	15.20%	28849.6	0.00628	0.47	16444	0.5	24	31	55
Jammu	415.06	434	10.38%	16442.958	0.00321	0.29	9372	0.5	4	12	16
Delhi	5524.73	10990	5.60%	224635.6	0.01192	1.00	128042	0.5	763	2570	3333
Mysuru	1332.25	450	7.77%	12762.225	0.02326	0.79	7274	0.5	67	1278	1345
Bengaluru	7249.66	6100	28%	623420	0.01845	0.90	355349	0.5	2965	4650	7615
Faridabad	802.77	850	5.60%	17374	0.01197	0.76	9903	0.5	45	120	165
Lucknow	589.31	1365	15%	74733.75	0.00815	0.95	42598	0.5	165	0	165
Ahmedabad	334.55	3300	4%	48180	0.00227	0.86	27463	0.5	27	26	53
Pune	874.56	1900	8%	55480	0.01657	1.00	31624	0.5	262	690	952
Kolkata	570.42	4500	6.07%	99699.75	0.00855	0.90	56829	0.5	220	0	220
Chennai	876.25	4593	8.38%	140486.091	0.00162	0.52	80077	0.5	34	0	34
Mumbai	3664.19	6533	7.52%	179317.784	0.03876	0.57	102211	0.5	1132	296	1428
Hyderabad	1804.88	6098	7.26%	161590.902	0.01815	0.95	92107	0.5	796	0	796
Guwahati	845.92	550	14.00%	28105	0.00810	0.71	16020	0.5	46	7	53

Thus the total recycling rate of UBCs for Indian cities in 2021 is estimated at 62% which is higher than 2018 study, where it was 54%. Based on the extrapolation of data along with secondary research and consideration of over 1000 cities, (based on Central Pollution Control Board waste recovery data on pan-India level, population Census, and paper recovery rate) in India the overall national recycling percentage is about 45%, implying that for every two UBC, one is recycled.

Estimation of UBC Reaching Dumpsites

As per the recent data released by MoHUA, nearly 35% of the total MSW generated in urban India is dry waste. Out of this, the reported recovery rate of dry waste is again 60% in India. Keeping these two factors in mind, the estimation of UBC reaching dumpsite is tabulated:

TABLE 73: Estimation of UBCs at dumpsite

City	Waste reaching landfill (TPA)	Load analyzed at dumpsite (kg)	Paper waste found (kg)	% Paper Waste	UBC Found (kg)	% UBC in paper waste	% UBC in total waste	UBC estimated at dumpsite (TPA)
Bhubaneswar	81614.0	21000	407.0	1.9	15.5	3.808	0.074	60.24
Kurnool	39237.5	9477	938.0	9.9	4.4	0.467	0.046	18.13
Trivandrum	63282.2	No dumpsite In Thiruvananthapuram						
Kochi	44678.3	1165	17.0	1.5	1.6	9.529	0.139	62.13
Chandigarh	80515.4	3100	4.0	0.1	1.8	45.0	0.058	46.75
Shimla	11261.2	2230	25.5	1.1	4.0	15.686	0.179	20.20
Nagpur	159147.3	2360	54.0	2.3	0.5	0.926	0.021	33.72
Dharamshala	2197.2	900	36.6	4.1	21.9	59.891	2.432	53.44
Srinagar	81614.0	15145	43.8	0.3	26.3	60.091	0.174	141.83
Jammu	68116.3	19000	38.2	0.2	16.0	41.924	0.084	57.41
Delhi	1724880.5	33000	45.0	0.1	3.0	6.667	0.009	156.81
Mysuru	70627.5	13450	124.1	0.9	8.4	6.774	0.063	44.15
Bengaluru	909525.3	24890	347.0	1.4	48.3	13.919	0.194	1764.97
Faridabad	125403.1	988	305.0	30.9	1.3	0.426	0.132	165.00
Lucknow	199240.2	28176	232.0	0.8	17.0	7.328	0.060	120.21
Ahmedabad	517935.0	2915	120.0	4.1	1.5	1.208	0.050	257.63
Pune	298205.0	2410	87.7	3.6	0.6	0.627	0.023	68.06
Kolkata	635647.5	5650	399.0	7.1	5.6	1.411	0.100	633.40
Chennai	699245.2	23400	246.5	1.1	10.8	4.381	0.046	322.73
Mumbai	1013562.8	7760	52.0	0.7	6.6	12.692	0.085	862.05
Hyderabad	957081.1	29060	552.000	1.900	0.940	0.170	0.003	30.96
Guwahati	86322.5	16404	1600	9.754	30.900	1.931	0.188	162.60

The analysis depicts that approximately 5250 tonnes of UBC is reaching the landfills in surveyed cities, with Indian cities corresponding to about 5082 tonnes. The mean value of UBCs found in MSW at the dumpsites in surveyed Indian cities was 0.198% with a standard deviation of 0.515% and best estimate of uncertainty as 0.118%. Hence we can present the average percentage along with the best estimate of uncertainty as 0.198±0.118%.

The average UBC found in dumpsite as part of MSW has reduced significantly from 0.65% in 2018 to 0.198% in 2021 courtesy the efforts undertaken by Tetra Pak India to recover UBC and divert them towards recycling.

However, the amount of UBCs present in the MSW may vary as waste composition changes depending upon the season.

Material Balance

UBCs travels from consumers to ragpickers or door-to-door collector and thereby to kabadiwalas. The kabadiwalas sell these to large-scale dealers or wholesalers, and further go recycling. The UBCs remaining uncollected and unrecovered although in miniscule quantity move to the dumpsite. The number of UBCs entering the environment is estimated in the material balance analysis given in Table 74.

From the above Table, it is quite evident that majority of UBCs consumed in India are being recycled and a small portion of it is going to landfills. However, a major challenge identified is the number of UBCs which remain unaccounted. Hence there is an opportunity to further improve the recyclability of UBCs in India by adding more infrastructure for collection and recycling.

The material balance analysis is further depicted visually in Figure 81.

TABLE 74: Material Balance Analysis of UBCs in India

Material Balance of Used Beverage Cartons in 2021 in India	
Key factor	**Quantity of UBCs (TPA)**
Total UBC consumption in the surveyed Indian cities	26425.95
Total quantity recycled	16366
Active recycling rate	9716
Inactive recycling rate	6650
Total uncollected UBCs	10059.5
UBC going to dumpsite	5082.4
UBC unaccounted	4977.1

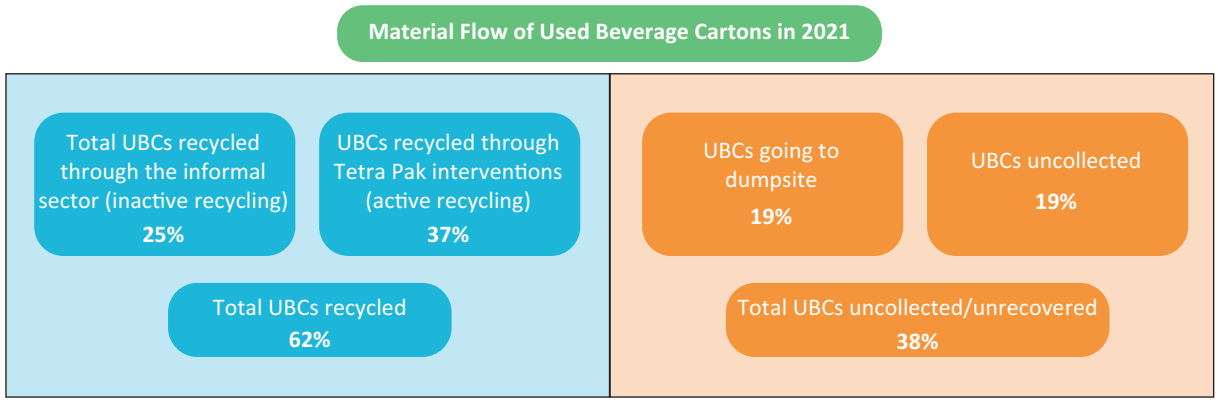

FIGURE 81: Material Balance of UBCs in 2021

Conclusions and Recommendations

As a part of this study, the value chain and economics involved in the collection and recycling of UBC was identified and it is observed that the recycling rates of UBCs have increased over the past studies conducted in 2011, 2015 and 2018 wherein the recycling where 29%, 43% and 54% respectively. The recycling rate obtained during the course of this study is 62% owing to the interventions of Tetra Pak in collaborating with various recyclers in strengthening the collection and recycling of UBCs by providing adequate infrastructure and technological solutions for dealing with UBCs along the value chain. As a result of which, the UBCs going to dumpsites has reduced significantly since separate collection and recycling chain of beverage cartons have been strengthened.

It was observed that despite COVID pandemic affecting the entire nation, the recycling rates have significantly increased over the past 3 years. During the pandemic, majority of the informal waste workers were displaced due to the national level lockdown in 2020. Several large scale dealers informed that the complete lockdown not only impacted the UBC management chain, but also the entire mixed paper waste stream. The inactive collection and recycling also picked up the pace, and it is expected that active collection will increase over time.

The following segment describes the existing scenarios of the cities surveyed in comparison to the previous study conducted in 2019 and also suggests recommendations to improve the collection and recycling rate of UBCs:

i. The formal active collection rates have increased significantly in multiple cities like Delhi, Faridabad, Srinagar, Jammu, Shimla, Guwahati, Bengaluru, Mumbai and Pune. The credit for this goes to the strong impact of Tetra Pak India interventions to make UBCs a more sustainable form of beverage packaging.

ii. In cities like Faridabad, Lucknow, Pune, Mysuru, Shimla, Srinagar, Delhi and Chandigarh, UBC collection rate undertaken by the informal sector has increased owing to an increase in the selling prices of UBCs and mixed paper in comparison to the study conducted in 2019. This could be attributed to the interventions of Tetra Pak in collaborating with recycling units and providing technological solutions to deal with the multi-layer packaging of UBCs. Unlike the study conducted in 2019, in Guwahati, the waste collectors, small scale dealers and large-scale dealers are accepting UBCs.

iii. In cities like Jammu, Mumbai, Hyderabad, Chennai and Kurnool, the amount of UBCs collected by the informal sector has reduced. The reason for this as mentioned by the respondents was a lack of dedicated UBC buyers in the market. UBC reaches the small and large scale dealers in these cities mixed along with cardboard and duplex. Active collection of UBCs and collaborating with recycling units can help in promoting the collection and recycling of UBC across the value chain.

iv. In cities like Delhi, Faridabad, Hyderabad, Srinagar, Lucknow, Pune, Mysuru, Chennai, Mumbai, Kurnool, Bengaluru the amount of UBCs reaching dumpsites have reduced substantially in comparison to the previous study conducted in 2019, because of improved collection and recycling of UBCs. This demonstrates that strengthening the collection mechanism of UBCs

across the value chain will lead to its disposal in a sustainable manner.

v. Chandigarh, Pune, Mysuru and Bengaluru have a recycling rate (both active and informal) of over 90%. This high recovery rate can be attributed to the dedicated work undertaken by Tetra Pak India partner organizations in these cities. It was observed that these cities have a dedicated UBC collection centre. A similar model may be replicated or attempted in other cities of higher UBC generation like Mumbai, Delhi and Hyderabad.

vi. The acceptability of UBCs by the paper mill is essential in establishing a proper market for acceptability of UBCs amongst waste dealers. This could be achieved through awareness generation and segregation of UBCs at source itself, along with advancement in technological solutions and infrastructure. In order to produce good grade quality of paper, the waste dealers should ensure in providing clean materials to paper mills.

vii. As highlighted by the waste dealers across the surveyed cities, a dedicated market needs to be established for collection of UBC which can facilitate active recycling of UBCs.

viii. Majorly, of all the cities surveyed, the key challenges as highlighted by waste collectors, small scale dealers and large-scale dealers for not engaging in the collection of UBC was the lack of awareness on segregation of UBCs at source level. Active efforts by the stakeholders involved across the value chain such as government, non-governmental organisations, and industries can overcome this gap and could enhance the collection and recycling rate of UBCs that are littered and do not enter the value chain. The potential of this is massive and may help achieve a recycling rate of over 70%, since in 2021, almost 19% of the UBCs remained unaccounted.

ix. The study and management of UBCs to identify the collection and recycling rate should be repeated every three years to assess the improvements in the active and inactive recycling rates. This will help Tetra Pak in effectively implementing their EPR targets as set by MoEFCC and regulated by CPCB.

Annexures

Annex 1: Waste Collector

Questionnaire 1.0 (Waste Collector)		
S. No	**Questions**	
1	**City**	
2	**Date of survey (DD/MM/YYYY)**	
3	Category	Rag picker / door to door waste collector
4	**Name of Interviewer**	
5	**Name of Supervisor**	
6	Name of Candidate surveyed	
7	**Type of waste collector**	
	a. rag picker	
	b. door to door collector	
8	**Address**	
9	**Contact Number /cell number**	
11	**Name of areas covered for collection of waste (also mention category: residential/commercial/institutional) and Ward and Zone of city**	
	a	
	b	
	c	
	d	
	e	
	f	
	g	
	h	
12	What all dry waste you collect for recycling	
	a. paper	
	b. plastic	
	c. glass	
	d. metal	
	e. cardboard	
	f. styrofoam	

Questionnaire 1.0 (Waste Collector)	
S. No	**Questions**
13	**Do you collect Used beverage carton (UBC)?**
	a. Yes
	b. No
14	**If answer to Question (13) is (a). How do you collect UBC?**
	a. Separate UBC collected
	b. UBC collected mixed with paper/cardboard
15	**If answer to Question (13) is (b). Why is UBC not collected?**
	a. no one returns UBC to us
	b. there is no incentive for UBC collection
	c. there is no buyer/market for UBC collection
	d. other.. (please specify)
16	**Average UBC collected per month (kg)?**
17	**Average mixed waste paper collected per month (including UBC) (kg)?**
18	**Per kg selling price of UBC?**
19	**Per kg selling price of mixed paper?**
20	**Source of procurement of mixed waste paper(including UBC)**
	a. Household
	b. street
	c. Waste bins
	d markets
	d. Others
21	From where do you get UBCs?
	a. Upper and middle class localities
	b. Lower income localities
	c. Commercial or Business establishments

Questionnaire 1.0 (Waste Collector)	
S. No	**Questions**
22	**Condition of UBC collected**
	a. Most do not contain leftover juice
	b. Most often soiled
	c. Clean and Ready for sale
23	**Fate of straw with UBC (small)**
	a. often found with packs (inside)
	b. sometimes found with packs (inside)
	c. normally not found with pack and is not collected
	d we collect straw separately for selling
24	Specify the fate of straw
25	**Specify the fate of UBC (if collected)**
26	**Anything that discourages you from dealing in UBCs**
27	**Any comment on how the collection and recycling of UBCs be improved.**
28	**What can motivate you for collecting UBCs**

Annex II: Small Scale Waste Dealers

Questionnaire 2.0 (Small Scale Waste Dealer who supplies to large scale dealers and Quantity handled <50 Tonnes/month of mixed paper		
S.no	**Questions**	
1	City	
2	Date of survey (DD/MM/YYYY)	
3	**Category**	small scale scrap dealer
4	Name of Interviewer	
5	Name of Supervisor	
6	Name of Candidate surveyed	
7	Type of waste collector	
8	Address	
9	Contact Number/Cell number	
10	Type of areas and zones covered for collection of waste (residential, commercial, institutional)	

Questionnaire 2.0 (Small Scale Waste Dealer who supplies to large scale dealers and Quantity handled <50 Tonnes/month of mixed paper	
S.no	**Questions**
a	
b	
c	
d	
11	No. of kabadi/rag picker contributing (from where you purchase it)
12	Total average mixed paper waste collected per month (kg)
13	Do you collect the Used beverage carton (UBC)?
a	If yes? Do you collect separately or with mixed paper?
b	If no? reason for not collecting
14	UBC collected per month (kg)
15	Per kg purchase price of UBC (per kg)?
16	Per kg purchase price of mixed paper (per kg)?
17	What is the selling price of UBC you get (per kg)?
18	What is the selling price you get for paper (per kg)?
19	Source of procurement of UBC
	a. household
	b. rag picker
	c. door to door collector
	d. intermediate kabadi
	e. others (hotels, shopping malls, markets etc.)
20	Condition of UBC collected
	a. Most contain leftover juice
	b. Most often soiled
	c. Clean and ready for sale
21	Do you process/treat UBC before selling
	a. Yes, (if yes, what processing do you do?)
	b. No

Questionnaire 2.0 (Small Scale Waste Dealer who supplies to large scale dealers and Quantity handled <50 Tonnes/month of mixed paper	
S.no	**Questions**
22	Specify the fate of UBC you get?
	a. Sell this to larger dealer
	b. Sell this to recycler,
	c. Sell this along with mixed paper,
	d. other....(please specify)
23	Specify the fate of straw?
	a. often found with packs (inside)
	b. sometimes found with packs (inside)
	c. normally not found with pack and is not collected
	d. you collect straw separately for selling
24	Anything that discourages you from dealing in UBC?
25	Any comment on how the collection of UBC be improved?
26	Bale analysis: (4 bales to be analysed of about 100-150 kg each)
	a. kg of mixed paper waste bales
	b. kg of UBC

Annex III: Large Scale Dealers

Questionnaire 3.0 (Large Scale Waste Dealer- who supplies to recycler and Quantity handled = >50Tonnes/month of mixed paper	
S.no	**Questions**
1	**City**
2	Date of survey (DD/MM/YYYY)
3	**Category**
4	**Name of Interviewer**
5	**Name of Supervisor**
6	**Name of Candidate surveyed**
7	**Type of waste collector**
8	**Address**
9	**Contact Number/Cell number**
10	**Type of areas and zones covered for collection of waste (residential, commercial, institutional)**

Questionnaire 3.0 (Large Scale Waste Dealer- who supplies to recycler and Quantity handled = >50Tonnes/ month of mixed paper	
S.no	**Questions**
a	
b	
c	
d	
11	**No. of kabadi/rag picker contributing (from which you purchase)**
12	**Total average mixed paper waste collected per month (kg)**
13	**Do you collect the Used beverage carton (UBC)?**
a	If yes? Do you collect separately or with mixed paper?
b	If no? reason for not collecting
14	**UBC collected per month (kg)**
15	**Per kg purchase price of UBC (per kg)?**
16	Per kg purchase price of mixed paper (per kg)?
17	**What is the selling price of UBC you get (per kg)?**
18	**What is the selling price you get for paper (per kg)?**
19	**Source of procurement of UBC**
	a. household
	b. rag picker
	c. door to door collector
	d. intermediate kabadi
	e. others (hotels, shopping malls, ,markets etc.)
20	**Condition of UBC collected**
	a. Most contain leftover juice
	b. Most often soiled
	c. Clean and ready for sale
21	**Do you process/treat UBC before selling**
	a. Yes, (if yes, what processing do you do?)
	b. No

Questionnaire 3.0 (Large Scale Waste Dealer- who supplies to recycler and Quantity handled = >50Tonnes/ month of mixed paper	
S.no	**Questions**
22	**Specify the fate of UBC you get?**
	a. Sell this to larger dealer
	b. Sell this to recycler,
	c. Sell this along with mixed paper,
	d. other….(please specify)
23	**Specify the fate of straw?**
	a. often found with packs (inside)
	b. sometimes found with packs (inside)
	c. normally not found with pack and is not collected
	d. you collect straw separately for selling
24	**Anything which discourages you from dealing in UBC?**
25	**Any comment on how could the collection of UBC be improved?**
26	Bale analysis: (4 bales to be analysed of about 100-150 kg each)
	a. kg of mixed paper waste bales
	b. kg of UBC

Annex IV: Dumpsite

Questionnaire 4.0 (Dumpsite Analysis)	
S. No	**Questions**
1	**City**
2	**Date of survey (DD/MM/YYYY)**
3	**Name of Interviewer**
4	**Name of Supervisor**
5	**Name of ULB official present (with designation)**
6	**Truck Registration Number**
7	**Type of waste collected**
	a. residential
	b. commercial

	c. institutional
8	**Route of present waste collection**
9	**Location of Survey (dump site name)**
10	**Latitude & Longitude of survey**
11	**Driver details**
12	**Cell Number**
13	**Average quantity of waste collected per truck per trip (short description)**
14	Total no of trips per day
15	**Total number of trips per month**
16	**Time of survey and comment**
17	**Total waste load in kg**
18	**Total mixed paper load (kg)**
19	**Total Quantum of UBC in kg**
20	**Any other observations**

Annex V: Paper Mill

Questionnaire 5.0 (Paper Mill)	
S. No	**Questions**
1	**City**
2	**Date of survey (DD/MM/YYYY)**
3	**Name of paper mill and contact person**
4	**Address**
5	**Contact number and email**
6	**Cell number**
7	**Name of interviewer**
8	**Total average mixed paper waste collected and processed per month (in kg)**
9	**Type of paper and board manufactured**
10	**Price of mixed paper you buy (INR/kg)**
11	**Price of UBC you buy (INR/kg)**
12	**Who all are your suppliers of Mixed waste paper and UBC?**
13	**Which sources contribute mixed waste paper UBC to your suppliers?**

a	institution
b	commercial
c	residential
d	other
14	**Which region contributes UBC and mixed paper to your paper mill?**
15	Total mixed paper load in the truck (in kg)
16	**Total quantity of UBC in kg found in mixed paper truck at paper mill**
17	**Total quantity of rejected material from pulper in a paper mill (kg/month)**
18	**Total quantity of UBC rejected during pulping (kg/month)**
19	**Fate of pulper rejected material**
20	**Fate of UBC rejected material**
21	**Other observations**
22	**Anything that discourages you from dealing in UBCs**
23	**What are the challenges to segregate the UBC from the mix?**
24	**If a segregation machine is installed in the paper mill, what will be the additional expenditure cost?**
25	**What do you do with the polyal if separated (during processing)?**
26	**Any comment on how could the collection of UBC be improved**


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