Action Research for Waste Reduction

How to Reduce Waste in India of the 21st Century?

chintan
environmental research and action group

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Acknowledgements

This report is researched by:
Chintan Environmental Research and Action Group
C14, Second Floor, Lajpat Nagar III, New Delhi 110024
Phone: +91-11-46574171 or 46574172
Email: info@chintan-india.org
Website: http://www.chintan-india.org/
Facebook: https://fb.me/ChintanIndia.org
Twitter: https://twitter.com/ChintanIndia
Instagram: https://www.instagram.com/chintan.india/

About Chintan Environmental Research and Action Group

Chintan is a registered non-profit organization with a vision of inclusive, sustainable, and equitable growth for all. Our mission is to reduce ecological footprints and increase environmental justice through changes brought about through partnerships, capacity building at the grassroots, advocacy and research, and sustainable, scalable models on the ground.

Lead Author
Bharati Chaturvedi

Chapter Credits

The following contributed substantially to specific chapters:

1. Chapter on Food Waste Name of chapter
Dr. Vivek Agarwal, Chairman WGCTT, International Solid Waste Association Chairman, Institute of Chartered Waste Managers
Dr. Vidhu K. Mathur, Senior Consultant, Professor, ICFAI University, Jaipur

2. Chapter on Global Plastic Reduction Policy
Malti Gadgil- Sustainability Strategist, HP
Kripa Ramachandran- Circular Economy / Solid Waste Management Specialist (Consultant) at Asian Development Bank

3. Textiles as Plastics
Tanvi Bhikchandani: Stanford University, Co-Founder of Tamarind Chutney, Sustainable and Fair Clothing Start-up
Charanya Shekar: Co-Founder of Tamarind Chutney, Sustainable and Fair Clothing Start-up
Amola Mehta: Student, Ashoka University

List of Abbreviations

BCI	Better Cotton Initiative
BMC	Brihanmumbai Municipal Corporation
CPCB	Central Pollution Control Board
CDL	Container Deposit Legislation
DST	Department of Science and Technology
ECOSS	Eco-tourism and Conservation Society of Sikkim
EPS	Expanded Polystyrene
EPR	Extended Producer Responsibility
ESIF	European Structural and Investment Funds
EU	European Union
FMCG	Fast Moving Consumer Goods
FAO	Food and Agriculture Organisation
FCI	Food Corporation of India
FLW	Food Loss and Wastage
GOTS	Global Organic Textile Standard
GCC	Greater Chennai Corporation
KCC	Khangchendzonga Conservation Committee
LCA	Life Cycle Assessment
MoHUA	Ministry of Housing and Urban Affairs
MoFCC	Ministry of Environmental Forests and Climate Change
MLP	Multi-layered plastics
MCGM	Municipal Corporation of Greater Mumbai
PMC	Pune Municipal Corporation
SBA	Swachh Bharat Abhiyan
SDG	Sustainable Development Goals
SUP	Single Use Plastics
TNPCB	Tamil Nadu Pollution Control Board
UK	United Kingdom
ULB	Urban Local Bodies
USDA	U.S. Department of Agriculture
EPA	U.S. Environmental Protection Agency
ZDHC	Zero Discharge of Hazardous Chemicals

1. Executive Summary

For the first time in its relatively young modern history, India is confronting the trash it generates. In 2015, it was estimated to generate 62 million tonnes annually. By 2031, this is projected to go up to 165 million tonnes. Waste was dumped in rivers, irreversibly polluting them. It reached landfills, resulting in burning, air pollution and greenhouse gas emissions. It would breed flies and spread illness. It was handled by a stigmatised population, unacknowledged. Solid waste was a silent crisis till 2014.In 2014, on account of the Prime Minister's Swachh Bharat Abhiyan, (SBA) there was a widespread conversation about waste, a relatively taboo subject previously. Now, in 2019, the Prime Minister has spoken of waste reduction, as he leads the way by banning and effacing Single Use Plastics.

Indeed, the heart of the waste issue is its reduction at multiple levels. It is both extremely expensive and a near impossibility to garner other non-financial resources to manage the waste we produce in India. Land is scarce, and so is pollution control capacity. While some parts of urban India show process innovation in terms of managing waste, the business case for un-subsidised scaled-up, clean technology based outcomes is yet to be well-established. The circular economy offers us one pathway - to extend existing materials and reduce the demand for fresh ones. Resource efficiency shows us another way. Indeed, the most efficient way to use a resource is to optimise its usage and reduce the quantity that is in circulation in the first place.

As we experience the climate crisis and scarcity of resources first-hand, we understand the importance of re-examining how we manage resources and materials. The challenge India faces is to dematerialise in part, while meeting the SDGs and fighting poverty. The primary problem around waste is not just its management, but its presence itself. It is waste per se that is the core problem. To address it, the solution lies within the framework of Resource Efficiency. Reducing waste, not merely projecting its increase as fait accompli, is an important aspect of this framework.

The universally accepted waste hierarchy puts waste reduction or avoidance on top, ahead of recycling, waste-to-energy and landfilling. All over the world, waste reduction has begun to be acknowledged as a key step going forward. However, India has a dual advantage: not only is the

country moving into an attitude of waste reduction on account of the Prime Minister's call, but it has a rich cultural legacy, still alive, of a combination of waste reduction and re-use, resulting in waste avoidance. This is seen in the *Rafoogaars,* or darners, in cuisine, where entire foods are based on leftovers, and everyday repair-men, such as cobblers, or *mochis*, whose work delays goods from being discarded. It also has a culture of fine-tuned artisanal skills applied to service provision prevents discarding as means of livelihood.

Waste reduction is not an idea that follows a generic pathway across various discards. For this reason, this study identified 3 sectors for waste reduction especially in the Indian context: Plastics, Food Waste and Textiles. In each case, both the SDG 12: Sustainable Consumption and Production criteria and SDG 11: Sustainable Cities and Communities, are addressed as is SDG 14: Life Below Water. Reducing waste helps India meet its SDG goals as well.

From December 2017 to January 2019, the media has been reporting that India generates 25,940 tonnes of plastic waste every day, attributing the source to CPCB. That adds up to 9,468,100 tonnes per year. Out of this, the CPCB states that 40% of the waste remains uncollected. This comprises about 3,787,240 tonnes per year or 10,376 tonnes per day. Such discarded plastics end up in landfills, drains, and pollute rivers and seas. These are mostly plastic bags, multi-layer packaging and films, which do not have value in the recycling market. Moreover, the Ganges has been identified as the 7th largest carrier of plastics into the oceans in the world. Some of it is already coming back to haunt us. According to IIT Bhubaneshwar, samples of sea salt from the coast of Odisha contained micro-plastics.

We identified plastics as the first waste type to be reduced on account of the immense harm it is causing to our environment and health, impacting our obligations towards SDG 14: Life below water. Moreover, as the Prime Minister has committed in June 2018 towards its removal by 2022, this waste-type became a research priority for this study.

Food waste is the second waste-type of discard the research focuses on. The issue has been widely discussed in India. Around 1% of GDP gets shaved off annually in the form of food waste. According to the Ministry of Agriculture and Farmers' Welfare, INR 50,000 crore worth of food produced is

wasted every year in the country. 1 million tonnes of onions vanish on their way from farms to markets, as do 2.2 million tonnes of tomatoes. Tomatoes get squished if they are packed into jute sacks. Overall, 5 million eggs crack or go bad due to lack of cold storage.

Food waste also means many other previous natural resources wasted. In resource terms, India is estimated to use more than 230 cubic kilometres of fresh water annually — enough to provide drinking water to 100 million people a year — for producing food items that are ultimately wasted. Besides this, nearly 300 million barrels of oil used in the process is also ultimately wasted. Wasting a kilogram of wheat and rice would mean wasting 1,500 and 3,500 litres of water respectively that is consumed in their production.

While several steps have been taken by the Government-both the Make in India and the Ministry of Food Processing Industries-the issue of wastage at the consumer end remains unattended to. This study examined the end of the value chain to identify how hunger and malnutrition on one hand and climate change and resource conservation the other could be attended to by reducing food waste. This feeds into SDG 13, Climate Change and the SDG 12.3 targets: SDG 12.3: 'By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.

India is admired globally for its textiles- cotton, jute and silk. However, in more practical terms, synthetic textiles have come to rule the roost. India is 2nd to China in the production of polyester yarn and staple. It produces 8.63% and 10% of the global production of polyester yarn and staple, respectively. In terms of exports, India is the 2nd largest exporter of polyester yarn (valued at (valued at 10974 INR crores INR or 1.55 billion USD) and the 5th largest exporter of polyester staple (valued at 1840.8crores INR or 0.26 billion USD). India is approximately in the top 10 producers globally for other synthetics like nylon and acrylic. Its main textile exports are cotton and polyester.

Such textiles, after their useful life, act like plastics. Not only do they lie in landfills or open dumps, but fail to degrade. There is no commercial technology available to reclaim the fibre. Such textiles are the new plastics. They are not being discussed enough. Therefore, the study took them as the third discard material in the study. Globally, environmental actions follow environmental damage

and outcry. While studies indicate synthetic textiles are already damaging, there is much that can be done yet to prevent further damage. It was for this reason that synthetic textiles were identified as part of the study.

This study identifies policy action that is both drawn from local and global best practices, as well as our own indigenous skills and knowledge-combining the best of Indian innovation and 'jugaad'. The several 'wallas' - or service providers- across various sectors have been included in the research, and their contribution sought to be strengthened. Each section comprises detailed recommendations for the specific materials, while a broader Way Forward chapter takes a wider outlook to waste reduction, beyond recycling, reuse, resource efficiency.

Finally, the aim of this research was to reduce waste in order to safeguard the environment- an obligation on every citizen in Article 14 of our Constitution - while seeking the betterment of human life.

This study looks at waste reduction in the three areas of plastics, textiles and food in India. A fourth aspect is that of traditional repair occupations, which also reduce waste. It is predicated on the understanding that key to the circular economy and solid waste management is waste reduction.

Methodology

The study has analysed the sectors using both secondary literature and primary data though a survey in selected cities of India. It has looked at existing legislation, where it exists, implementation, consumer behaviour and challenges in waste management in these three sectors. Based upon the analysis it has identified various areas to reduce waste, and include policy and regulatory mechanisms, behaviour change and role of technology and entrepreneurship. Given the rich traditional reuse and repair skills available in India, there is also, presently a major opportunity for promotion and upgradation of such traditional skills as green livelihoods in the resource efficiency framework.

The primary data collection included a Knowledge, Aptitude and Practice (KAP) study to help understand existing situation and issues in the identified study sectors. The various tools used were

both on and off line survey of a thousand individuals, a face-to-face survey in the five study of residents in the five Indian cities of Bengaluru, Kolkata, Bhopal, Ahmedabad and Delhi, and interviews with practitioners of traditional crafts and repair skills that help reuse and reduce waste. Interviews were also conducted with a cross-section of other stakeholders and specialists, such as Mission Directors of the Swachh Bharat Mission, scientists, journalists, recyclers and business owners, specifically in the three states of Maharashtra, Sikkim and Tamil Nadu where significant policy action has been undertaken in plastics. Finally, a landfill study for Delhi's Bhalaswa landfill was carried out to specifically understand the textile waste sector. This data combined with the secondary data has been used to develop this report and its recommendations.

What were the key findings?

People understand waste management better than waste reduction. According to the KAP study in the five cities of Bengaluru, Kolkata, Bhopal, Ahmedabad and Delhi, residents were aware of the term waste segregation, although it was minimally practiced Additionally, there was limited knowledge on waste management rules and penalties for non-compliance by waste generators. However, awareness on the 3Rs was known in all the cities. Certain traditional repair services, such as tailors and cobblers were used to repair clothes and shoes. Utensil repair services were also observed especially in Ahmedabad and Kolkata. Recycling was also practiced by selling household items to *kabaris*. However, the understanding of waste reduction was not reflected in any of the cities.

Plastic waste:

Experience in the management of plastics globally suggests two popular methods for their management: bans and charges. While recycling of plastics exists, it is limited in use mainly due to the complexities of recycling plastics. Bans have been tried around the world, with Berkley, USA a Disposable Free Dining Ordinance identified that dine-in would only use reusable food ware, and take outs would be charged for. **Across California, compostable plastics are being encouraged as a step to fight plastic waste. On the ground in California, such plastics could only be recycled in industrialized composting facilities, if they were locally available. However, a Chintan visit observed that these were not typically available. Moreover, the compostable plastic was mixed with other plastics and looked similar, hence was difficult to segregate, making even the plastic**

recycling difficult. Similarly, in France there is a plan underway to do away with all plastic goblets, and replace all plastic bags with compostable material. Using bans on plastics has a definite reduction in their use, as was seen in Ireland, where reductions of up to 90% were noted *when followed* with a carrier levy on bags. In general, charging an explicit fee is seen to reduce the use of plastic bags. On the other hand, in Bangladesh, plastic bags were banned but they continue to be used due to weak enforcement and poor implementation. The EU approach has been to consider curbing plastic waste and littering, improving product design towards a circular economy and recycling, innovation and investments for circular solutions, and working towards trans-boundary and global commitments for plastic waste standards.

Apart from government, corporates have also taken steps to manage plastics. Danone, the French company has a collection and close-loop bottle to bottle recycling, Coca-Cola Pvt Limited has identified a few 'zero-waste' cities, where they hope to create behavioural change among consumers, and Unilever has pledged to reduce 30% consumption of plastics weight by 2020. However, lightweight may not solve the challenge of post-consumer waste, as many non-recyclables, the Single Use Plastics have shown us. Other companies too, such as Dell, Trek and HP are pledging to reduce reliance on virgin plastics. It is also noteworthy that attempts to blend plastics in cotton clothing is not an environmentally sound practice. It reduces the recyclability of the cotton and it is rendered into a synthetic fibre.

In India, state governments have been taking actions to reduce single-sue plastics. The actual impact is uneven. In the case of Maharashtra, where a ban was put in place, subsequently, there were amendments that led to a dilution of the regulations. This also resulted in the ban being considered to be a failure by the public, with around half the respondents of the KAP survey suggesting this. Others reasons identified for the failure of the ban included, poor enforcement, lack of engagement with stakeholders and informal recyclers, black market of goods from across state borders, and no action plan to tackle rehabilitation whose livelihoods were impacted by the ban. As in the case of Maharashtra, in Tamil Nadu too, while the state-imposed ban on plastics was initially successful, over time it too saw an increase in the use of plastics once again. However, there was, according to the KAP survey, about a 24% increase in the replacement of certain items such as plastic carry bags and cutlery by eco-friendly alternatives. These also generated livelihoods. Overall, however a third of those surveyed considered it a failure, and half suggested that banned items

were still available in the market, therefore resulting in the ban not being completely successful. Challenges in Tamil Nadu were the lack of economically viable supply of alternatives, and poor monitoring and implementation. In the case of Sikkim, the ban resulted in the proliferation of non-woven polypropylene bags (PP bags), thereby reversing impacts of the ban. Equally, there were no cheap alternatives available to ensure the complete banning of plastics, although it was noted that there is an emerging interest go plastic free and zero waste. Another challenge identified was food, such as noodles, and other packaging like that for personal hygiene products that contributed to the plastic waste in the state. The State Government and Gram Panchayats have however, banned packaged water for their functions. A trend noticed in all three states was the disproportional burden of the bans on the street vendors, and small businesses, as viable and economic alternatives were not easily available for them. With a rich artisanal tradition, India has a unique repository of alternatives which should be used to develop alternatives.

Textile waste:

Fast fashion and manmade fibres have seen a rise world over. However, this has also resulted in an increase in pollution and environmental degradation. These problems are a combined impact of the resistance to decomposition of manmade fibres and high impact production systems in the case of synthetic fibres. Synthetic fibres also, through their life, shed microfibres, which are not biodegradable, resulting in their increased accumulation in the environment, leading to metabolic disorders amongst animals-a new globally acknowledged challenge. There is therefore a need to address concerns of waste management from synthetic textiles. Technologies for recycling synthetic fibres are not yet commercially viable.

There is presently very limited regulation for the management of textile waste. In the European Union, there is a ban on hazardous chemicals and restricts many chemicals used in these textiles. In case of the US, there is regulation on microfibre pollution. The state of Connecticut has passed a bill in 2018 that has resulted in increased consumer awareness generated by the representatives from both apparel and environment community on reducing shedding of microfibres during washing of clothes. Similarly, bills have also been passed in New York and California. Presently in India, there is no law specific to textile waste.

Some like H&M has also started 'close the loop' initiatives for recycling. Although, sourcing sustainable and conscious fashion reduces the impact on the environment, mixing synthetic fibres they create another range of issues of sustainability and waste. Within India, there is the clothing company Pure Waste, located in Tiruppur, Tamil Nadu, which recycles waste textile into usable garments.

Technology is also being used for production of other fibres such as from discarded milk- QMilk, banana and hemp. Natural dyes and minimising waste from the manufacturing processes are also other initiatives underway. However, such technologies are expensive and cannot at this stage be a viable mass product.

Food waste:

This section focusses on post-consumer food waste.

India, an estimated twenty-one million metric tonnes of wheat is wasted annually due to improper storage, almost equal to Australia's production, according to an Asian Age article in 2017. Postharvest loss due to lack of food processing and storage facilities are estimated to be about NIR 2 lakh crore annually, according the Associated Chamber of Commerce. On the other hand, according to A 2018 Reuters report suggested that 194 million Indians go to bed hungry daily, with India's rank in the global hunger index being 103 of 119 in 2018.

Reasons for increasing food waste have been attributed to modernisation of food processing leading to increased consumption. This is also affected by cultural factors, socio-demographic elements and the regulatory environment. Food processing creates wastes such as corn husks and meat leftovers from cuts, which become industrial waste. Also, urban shifts such as takeout and eating out tend to result in increased wastage as compared to eating what is cooked at home. Keeping to shelf life of food also results in food being disposed prior to expiry, leading to wastage and a burden on the environment.

Countries with long standing food traditional and rituals, such as France and India, are considered to have a strong appreciation for food, and less likelihood of throwing food away. Culture also impacts the way we buy and store food in our houses, which is often directly related to wastage. This study showed the city of Paris has promoted innovative food waste prevention by encouraging

entrepreneurs to reuse food waste into new foods. India has a long tradition of using all parts of food, even leftovers, that is fast dying.

In the US, citizen led movements on food waste has led to a number of bills to address the issue. A key focus of US regulation has been to give away food before it is spoilt. This includes regulation to shield donors and food recovery organisations from criminal and civil liability from age, packaging or condition of donated food. There are also protections to food banks that charge a fee to recipients, and others to protect donors who give food directly to people. Tax incentives to help offset costs for donors have also been created, and in some states, a tax incentive for food donations is also in place.

Another area of legislation has been of organic waste bans. These are to prohibit the generation of large quantities of food waste reaching landfills. This is to compel food waste generators to reduce waste output. Strategies adopted here include food donation and composting. This has been tried in five states in the US. In the case of one such state Vermont, the banning of food waste has resulted in an increase of food donation by about 40% according to the Vermont Foodbank. The US Department of Agriculture in 2015 with the US Environmental Protection Agency have set a goal to cut food waste by half by 2030. Actions to undertake this include donations, animal feed, industrial uses such as energy recovery and composting. Canada too has a National Zero Waste Council, 2018 to recover unused and unspoilt food from retailers, manufacturers, restaurants and caterers for charity. The EU Circular Economy Package, includes a call for EU countries to take action to reduce food waste at each stage of the food supply chain, monitor it and report back. The EU has also identified a number of actions to support achieve the Sustainable Development Goal targets for food waste, amongst other actions. France, has a law, Waste Management Enforcement Law, which regulates organic waste, and requires supermarkets, agriculture companies and much of the hospitality to limit food waste to less than 10 tons annually, or face stiff fines. It also prohibits throwing of good quality food by supermarkets, resulting in an increase in donations of these foods. Both Berlin and Paris have also involved residents in actions towards reduction food wastage. Similarly, other countries like Japan and Pakistan have also enacted laws that helps reduce food waste. In Pakistan, the state of Punjab has restricted food items at weddings.

In India, although not directly in the context of food waste management, there have been various regulations that result in reduction in food wastage. These include the Delhi Guest Control Orders

of 968, 1972 and 1976, and also have similar rules in Assam, Jammu and Kashmir, Andhra Pradesh, Maharashtra and Rajasthan. These have lapsed now and were also considered too severe even during their time. This apart, the Supreme Court of India has also expressed need for regulating guests and food served at weddings.

India's traditional knowledge

India has rich traditional knowledge and skills and many individuals and families from rural and urban areas engage in traditional work. These services increase goods life and also reduce wastage. However, with increasing modernisation and westernisation, their work is experiencing lower demand which is causing financial sand social tress among these workers and loss of traditional skills and knowledge. These include cobblers, tailors and darners, and utensil and knife repair amongst others.

Twenty case studies were undertaken with diverse actors for this study. Key finding included significant challenges to access markets, space and credit. Many pointed out that they were losing out to potential clients as they were no able to recall that such services existed, and if they did, there was no access to them. They also spoke about challenges of space and visibility. The Right to Repair is already embedded in India and it must be leveraged to create more robust micro-enterprises.

Action Points- Short, Medium and Long Term

Report analysed three sectors **plastic waste, textile waste** and **food waste** and one framework of **traditional occupations** though analysis of data, discussions with experts, review of literature

- Actions on waste reduction to be undertaken in Mission Mode, as it involves multiple agencies and tasks, which have to act in sync with each other, with other projects and based on targets.
- NITI Aayog SDG India Index, 2018, could incorporate waste reduction in a new section comprising SDG 12. This will spark competition as the baseline is set for each one.
- Based on the measurement of waste reduction, states – both big and small - should be ranked and rewarded. Rewards can include fiscal means to further reduce waste, scale-up, etc.

- Need to catalyze public opinion to reduce waste. Intensive campaign to encourage people to Have Less is essential. Using informal sector services for waste reduction should also be seen as desirable and on-trend, for widespread public acceptance.

Plastic and Plastic Waste

Short Term

A. Policy and Regulatory Instruments- A number of policies and regulations exist for the management of plastics and plastic waste. Bans to be legislated with ensuring enforcement and creating incentives/disincentives to encourage reduction in use of material.

- *Harmonise the Rules and Policies*- Rules differ across states creating challenges for implementing agency or brand owner working or designing products for sale across India. National harmonisation must reflect consistency on sizes and materials disallowed and undertaken by the MoEFCC.

- *Extended Producer Responsibility* -EPR is already being used India for plastics (and E-waste).

Companies must integrate informal sector for upgrading EPR as follows:

- EPR must work with ULBs to support and invest in decentralized Material Recovery Facilities.

- EPR to work with SPCBs to set up decentralized plastic recovery units to extrude and mould certain plastics, particularly LDPE and HDPE.

- Recycling to be included in list of MSME and all help be extended to them by relevant ministry.

- Prices for virgin plastics globally at a low making recycled plastics more expensive than virgin plastics, killing market for recyclables, and closing recycling units. EPR to invest in recycling units, to give boost and fiscal incentives to open and function. To be synched with government needs for state procurement to help uptake. Funds from EPR and from taxing virgin plastic industry.

Existing EPR Mandate to be expanded in PWM Rules, 2016, Rules, and apply to MLPs, Tetrapak, Styrofoam, textiles with synthetic components. Must apply to brand owners, manufacturers and e-commerce. Laws notified within 9 months of year. Guidelines issued, with year wise targets to collect, recycle and report back.

Developing Alternatives to Plastics

- To sustain ban by providing material alternatives and process alternatives and ensure continued supply. Investments in micro or medium industries with Government help in making them cheaper till scale reached. Process alternatives include *Bartan Bhandars*, or Crockery banks, to displace plastic crockery.

- Every alternative is first verified by a state level task force, based on national guidelines. The task force at state level will comprise state government and agencies outside government, to verify the bio-degradability, safety and possible challenges of the material as a plastic alternative and issue a go-ahead. The task force can be state-wide, with representations in cities. All state task forces should be able to communicate with each other for mutual strengthening through a formal process.

B. Building ties with the informal sector-Informal sector work, despite the rules, has been poorly integrated in plastic waste reduction. Some key ideas for expediting this include:

- Decentralized Material Recovery Facilities run by wastepickers across every ULB
- No MRF to handle more than 5 tons per day
- Decentralized recycling into pellets of specific plastics, meeting pollution control norms
- Informal sector must be mapped in every ward, across their various roles in the chain. Each one must be registered and given an I card, which entitles them to social security (such as ration, pension, accident and life insurance, and quality health care)
- All waste workers, including those in the informal sector, to be declared essential services
- Recycling to be declared an essential service

C. Influencing Behaviour

As the KAP survey suggests, there has been awareness on the impacts of plastics either though the national government's Swachh Bharat Mission, or from other media actions.

- This must be used further to create responsibility among consumers and lead to public participation to reduce plastic usage.
- Campaigns have to be at least state level, in sync with future regulation and building public. They should also open the eyes of the public to the informal sector.

Medium Term

A. Policy and regulatory instrument

Plastic Bans- Global experience suggests bans to be policed, awareness and strategic implementation important. Lessons for India for single use plastics:

- Implement bans phase-wise, with the easiest items first.
- Seek alternatives and advertise and promote them widely.
- Some single use plastics (SUPs) don't have alternatives, such as small sachets, and should be put in the final phase of the ban.
- Bans should be extended to all non-medical-use plastics and not merely restricted to plastic bags.

  In Phase 2, ban could be implemented on:

- Coffee cup lids, plastic plates, plastic and thermocol glasses, spoons, folks, knives, plastic lined glasses, PET water bottles of less than 200 ml. Adequate alternatives need to be ready.
- Wet wipes, flexi-banners

Clarify and verify alternatives

- Often, bans do not clarify what is precisely being banned. The Maharashtra Plastic and Thermocol Products (Manufacture, Usage, Sale, Transport, Handling and Storage) Notification 2018 was amended on April 11th, and again on June 30th 2018. However, 'non-woven' material ban was not included leading to misinterpretation and a proliferation in the use of non-woven plastic bags that resemble cloth bags finally leading to the government releasing a pictorial representation of banned materials. In the case of Delhi, several shops were flooded with woven HDPE bags, which were plastic but looked like textiles.
- Therefore, there will be a need to periodically review alternatives put in place, as new items appear as alternatives, and identify if they are appropriate for use.

Strengthen Enforcement

Expensive and difficult to police for compliance. In Tamil Nadu, the ban was weakened when policing stopped. In Ireland, the pricing of plastic bags also slipped when policing was stopped.

- Special force with SPCBs to handle plastics recommended. Funds from fiscal taxes and via EPR to be used to ensure such teams are hired and located within ULBs and Panchayats.
- Citizens trained and specifically selected for period of 2 years to be included in monitoring. They should not be given powers of fining or correction. Local level organizations, and representatives such as councilors at wards and Sarpanchs, to be trained to monitor. Citizens groups, like Lions' Club, Rotary Club, NGOs, Schools, etc. to be called into action to monitor and report absence of compliance for enforcement.

B. Fiscal Instruments- can be used to discourage and create disincentives on use of plastics. Should be mandatory to charge minimum surcharge for selective items, till ban is completely effective. Diverse committee to identify fiscal measures for plastics, with a focus on non-recyclable plastics. These can be at the level of brand owner and retail (straws, plastic bags, food containers etc.). The possible actor involved can be the National Institute of Public Finance and Policy (NIPFP).

C. Influencing Behaviour - Awareness can lead to public participation. It also makes clear what the laws are. Besides, awareness means several organizations can be made part of the implementation.

D. Technologies and Entrepreneurship -DST lead initiative to identify existing and emerging recycling technologies for plastics. Ongoing research mapped to understand state of research for recycling and reuse and identify most promising technologies to invest in, and further developed and supported. Small scale recycling to be encouraged to meet industry standards. Reduction of plastics by blending into natural fibres not to be encouraged.

Long Term

A. Policy and Regulatory Instrument

Ban on SUPs- Multi-Layered Packaging (MLPs) can be banned

- Recover materials from MLPs
- Identify other forms of dispensing edibles currently in MLPs, through dispensing units etc. to minimize packaging

B. Technology and Entrepreneurship

Presently, reducing packaging waste is hard to replace as well as recycle. Funding for both design and materials that reduce plastic waste is essential. DST should hold "dematerialization challenges" that encourage the development of technologies and bring them to commercial scale.

Textile Waste

Short Term

A. Policy and Regulatory Instruments

Reducing pollution by synthetic fibres

- Controlling micro-fibres at source: laws should require that garments containing synthetic materials should be pre-washed in the manufacturing unit 10 times, using techniques to save water and capture and sequester micro plastics.
- Additional standards for washing machines: law that requires micro-plastic fibre capture systems in every washing machine.
- Consumer information: Garments can be labelled with the instructions on their disposability instructions for consumer awareness.

Elongating product lifecycle

Traditional micro-entrepreneurs, such as *Rafoogaars* and roadside tailors, who undertake repair, require boost in form of space, recognition for their work and upgradation of skills

B. Influencing Behaviour

Green Procurement

Government to consider green procurement as it procures for a range of uniforms, soft furnishings, etc. - to be mandated to be of natural fibres only. Positively impact pricing.

C. Technical and Entrepreneurship

Government, through DST, and other arms, to initiate technology innovation that will be:

- Using fewer synthetic textiles to make garments - to reduce the filaments per garment
- Harvesting other materials for sustainable textiles while identifying the carrying capacity for harvesting. These include banana fibre, spider silk, etc.
- Recovering fibres and filament from old clothes. Investment in this technology to bring it to commercial viability to reduce the waste from synthetic textiles.
- Having Invest India include waste reduction in its portfolio.

Medium Term

A. Policy and Regulatory Instruments

Reducing pollution by synthetic fibres

- Create recycling and material standards for synthetic-fibre based textiles, including clothing, that every brand and manufacture must adhere to. Should include micro-plastic and micro-fibre emission standards, standards to monitor these and processes to handle captured plastics.
- Labelling: Introduce tabled bills that recommend advertising the proportion of the constituent fibres to detail the percentage of synthetic fibres in their fabric. These would also serve the purpose of informing consumers about the dangers of microfibre shedding, as well the ways in which they can reduce the damage.

Pre-Loved Garments and micro-enterprises

Exchange of clothes and increasing the life of garments to reduce waste in the longer run. Action to help with providing livelihood opportunities through micro-enterprises:

- Set up small fund for a starter kit for such micro-enterprises. To include materials and advertising for a limited time, on social media etc.
- Encourage clothes exchange stall at all green meets where the government is a partner
- Create Guidelines for second hand clothes businesses to increase market confidence

Fiscal Actions

- Creating incentives such as tax breaks, reduced or no GST and special packages for entrepreneurs involved in recovery of synthetic materials for circular pathways. Not to include waste-to-energy and end-of-life and end-of-pipe technologies, as there is little innovation here.

B. Influencing Behaviour

Govt. with CSOs to launch awareness campaigns to influence consumer behaviour about fast fashion being major driver of textile waste and pollution. A reduction strategy to reduce wastage and discarding of usable textiles

Use of Alternate Fibres

Natural alternatives like natural fibres, such as cotton, linen and silk, and new fibres like banana and pineapple fibres to be promoted over synthetic by increasing demand through consumer awareness and targeting consumer behaviour change.

C. Technology and Entrepreneurship

Technology and R & D required for reducing synthetic fibres. More investment is required in the sphere of textile pollution. Some technologies to recover strong fiber from polyester for re-manufacturing synthetic fiber exist, but these are not at a commercial scale.

- Incentives for innovators like tax breaks, subsidies as well as supporting research. Invest India and the Ministry of Textiles must foster such innovations.
- Embed such entrepreneurship in the micro, small and medium enterprises to socialise technology and entrepreneurship, create livelihoods and fight poverty.
- DST to identify existing and emerging recycling technologies. Ongoing research should be mapped to understand the state of research for recycling and reuse and identify the most promising technologies to invest in.
- Set up a global competition, open to any company or consortium, with state facilitation on these lines, to roll out in India, under Make in India.

Long Term

A. Policy and Regulatory Instruments

Fiscal Actions

- Design houses, start-ups and those using 100% natural fibres and materials to be given tax benefit to encourage a shift. Regular and strict audits to evaluate the production process of companies, to dictate the terms of engagement with them.

Use Extended Producer Responsibility

- EPR framework for brand owners manufactures and retail manufacturing or selling any form of synthetic fibres to be created. To include take back, reprocess or use the materials in ways as authorized by CPCB. To include clothing and materials with upcycled plastic content. All companies and brands to be covered under this. To include recycling 100 percent of the synthetic textiles and accessories (such as buttons) within 10 years to prevent dumping in landfills or plastic pollution.

Food Waste- Post Consumer and Retail Waste

Short Term

A. Policy and Regulatory Instruments

Setting Targets and measuring waste management- Swachh Sarvekshan to include waste reduction as parameter for every municipality.

Reducing wastage

- Unsold farm crop in good condition to be used in mid-day meals with help of Education Dept.
- Unsold foods nearing expiry date to be sold off at discount 48 hours before the date.
- Municipalities to issue orders for retail stores to give away unsold foods.
- Formal sector retailer to submit plan to local municipality for the prevention of food waste in order to get licensed to operate. To include improved storage, selling food at discounted rates before its expiry, awareness, and tie ups with food banks.
- Municipalities to encourage waste food being sent to registered piggeries or as other animal feed as appropriate, to allow for food to be used as animal feed instead of dumping.
- A special focus must be on caterers to prevent food waste.

B. Influencing Behavior:

- Waste reduction can be encouraged by recognising and rewarding municipalities that have demonstrated 50% or more reduction of food waste.
- Making prevention of food waste part of the Swachh Bharat Sarvekshan, to foster awareness of it as an urgent issue.

Creating awareness and demand to reduce wastage among consumers

- Leadership builds trust: All government sponsored meals must contain one item created from a typically unused part of a plant to break hesitations and fears about untested foods and encourage culinary innovation around these.

Medium Term

A. Policy and Regulatory Instruments

Possible crops being dumped due to low or no prices can be diverted for mid-day meals, if there are no quality problem, and retails stores with raw fruits and vegetables in urban areas may also be linked to feeding or food donation programmes. In urban areas, improving food storage, tie-ups with food banks, or even providing unusable food for animal feed, is a step ahead.

B. Influencing Behaviour

Food choice is personal and consumer driven. Hence influencing this segment and building a strong constituency of support amongst the middle classes is the foundation for all other steps. Some actions are as follows:

- A multi-pronged campaign to help people to understand negative impacts of wasting food.
- Working with influencers in the food world such as chefs, restaurant owners, food critics etc. to:
  - Embrace the culture of eating more parts of each food, to reduce wastage as well as re-discover India's ecological heritage of food.
  - Reduce aspects of food plating and garnishing that cause food waste. This including elaborating carving and plating and dining décor from edible items
  - Standardise portion size overall and train constituencies on this
  - Develop a prevention protocol for food types that are wasted after being served.
  - Agree to serve guests smaller portions if they request, at no price difference
  - Give away fewer perishable foods for charity.

Creating awareness and demand to reduce wastage among consumers

C. Technology and Entrepreneurship

- Preventing food waste can spawn start-ups, as we have seen in the case of Paris. They will need financial and market help to start -up and build consumer confidence. The Ministry of Micro, Small and Medium Industries should set up a programme to encourage enterprises in this sphere.
- Farmers often receive reduced amounts for their crop, and eventually dump it as it is no longer viable to sell it. Technology can help connecting farmers with buyers who may be able to pick up the crop from the farm under the circumstances for value addition. Farmers may also add value to it to prevent its wastage. This may be identified for specific crops and regions, such as tomatoes across India. The crop wastage may also be avoided.

Revitalizing Traditional Skills – (Skills that reduce waste by extending the life of a product. Eg. Cobblers, *rafoogars,* knife sharpeners)

Short Term

A. Include them as part of Swachh Bharat Mission and other schemes

- Sector to be mapped in every ward, across their various roles. To be registered and given I card
- Set standards for their occupational safety and work environment. Trained to improve digital savviness and be able to undertake basic accounting as required for a micro-enterprise
- Include these professions as part of micro-enterprises, so relevant ministries are able to help
- Recognize them as essential for circularizing the economy.

B. Influencing Behaviour

- A massive awareness campaign to convince the public to use this sector's services.
- Campaign on local and indigenous ways of reducing waste
- Awareness for actors providing the services, to enable them access the services available for their benefit and to create their own market linkages.

Medium Term

A. Policy Action

Allocate formal space

Most actors either use public land (roadside cobblers) or rent land (repair shops) for their work. Cities and districts to incorporate such actors at the ward or other levels as part of zonal plans in ways that they are able to be seen by clients and potential clients.

Procurement by government

Government's procurement policies to include procuring goods that can be repaired or made locally in the circular economy. In each district, a short-listed number of such service providers may be identified with rates for all such jobs. This formalizes and encourages the use of these services. Market access for mapped goods that reduce waste in their production or other parts of their life-cycle, or upcycled products, has to be inbuilt in the relevant schemes as well as all procurement, from gifting to usage in offices.

The Right to Repair (RtR)

RtR is a cornerstone for consumption globally ahead. India already has such an ecosystem. Hence, RtR must be made part of any policy on resource efficiency, livelihoods and urban waste management. Some aspects of this should be identification, inclusion and upgradation of the actors, access to market and credit and skilling and recognition as micro-entrepreneurs.

Enhance access to credit

Many of these persons are unable to take small loans to upgrade their work and equipment, essential to their earnings. A policy enabling access to credit as well as subsidies on equipment required by them will foster entrepreneurship.

B. Technology and Entrepreneurship

- Map the range of actors and identify their perceived and other technological gaps. In some cases, technology can also be used for market access, such as in the case of service aggregators. Some of the technologies used are excellent examples of low-tech, high value. These include the cycle-pedal case of knife sharpeners. Some, like the cobblers, might need ergonomic interventions.
- The service providers require skill training to transition into formal sector entrepreneurs and take advantage of several existing schemes, including loans etc. This should be provided to them in a format that is easy for them, including the number of days, timings, content and post-skilling hand-holding.
- Aggregating such persons at a city-wide level is key, for easy access

Create a Market

A. Influencing Public Action

Influence the public in the form of campaigns, mentions by influencers and stories about their work in the media, to use their services. The ULBs should be part of showcasing them in wards.

B. Access to Markets

Access to market can include:

- linkages with service aggregators
- promotion by state governments
- inclusion in on-line directories

- enabling work in spaces that are accessible and visible to potential customers.

This report identified short, medium and long terms action points for 4 sectors, in order to reduce waste. While these will be undertaken by various ministries, a centralized cell within the SBM should be formulated to ensure that these activities are coordinated and guided by the best knowledge.

Waste reduction, resource efficiency and re-circulating materials remains the only way ahead for India.

2. Methodology

The research methodology for this study was a combination of primary and secondary data collection, analysis and triangulation. This study aimed at identifying, through multiple forms of primary and secondary research, existing global policies and global and Indian practices of waste reduction that are relevant to the Indian context.

2.1 Primary Data

Primary Data was collected using a Knowledge, Attitude and Practice Study (KAP) for understanding the place for legislation and preparedness amongst Indians in waste reduction as well as identifying innovative and older practices of waste reduction across India. This was done as follows:

a. In the form of 1000 online and offline surveys. 500 online survey forms were emailed to identified persons on our list, 200 focusing on people above 50, 150 on people between 30 and 50 and 150 on respondents 18 to 29 years of age. Since WhatsApp is also popular, the survey was sent on this medium as well as on Facebook to people using the same criterion. Of these 152 responded.
b. Offline, or face-to-face surveys were undertaken in 5 cities of India, each with 100 respondents broken into 35 each from slums or rehabilitated housing, 65 from economically privileged areas, comprising both residents (35) and their domestic help or other workers serving the areas (30). The 5 cities were:
    - Bengaluru (South)
    - Kolkata (East)
    - Bhopal (Central)
    - Ahmedabad (West)
    - Delhi (Central and North)

In each city, a recce was done to identify any particularly unusual form of reuse. This was listed and shared for inclusion, if relevant, in the report.

a. Interviews with 20 practicing crafts/repair persons and those engaged in traditional production practices where old materials are reused or reduced. The 20 were drawn

from a wider list created based on interviews and inherent available information. Chintan selected 100% of the case studies from Delhi as, based upon our preliminary understanding, an adequate range of such trades, skills and crafts could be identified here itself. These resulted in 20 case studies.

b. By interviewing a range of almost a 100 stakeholders comprising of Swachh Bharat Mission officials, Mission Directors (Swachh Bharat Mission), scientists, journalists, recyclers, business owners, health officers, plastic manufacturers, environmentalists and consumers in Maharashtra, Tamil Nadu and Sikkim to understand the impact of the various single use bans in these states. This was done to provide an in-depth understanding of one policy.

c. In the case of textiles, a 3-day study was carried out at Delhi's most active landfill, Bhalsawa. An experiment was set up where a waste trader was asked to buy old cloth and textiles for 3 days of December 2018, after a 2-day awareness campaign. She was given the cash to pay them the same rate as low value plastics, (Rs. 3 per kg), also being retrieved from the landfill at that point. This rate ensured there was an incentive to pick up the waste. Since it was limited to 3 days, a relatively low rate acted as a disincentive to pick up only textiles to make a quick buck. Therefore, we assumed that they would give us only recently dumped textiles and not dig out the landfill for older ones. The available materials were classified and weighed, as well as examined to ascertain how long they had been in the landfill. This helped us to identify the range of textiles finally dumped in landfills.

2.2 Secondary Data

a. Secondary data was used to research global policies. These were researched on-line, through guidance manuals as well as via help from specialists in the area globally. The research was cross-checked by talking to experts to nuance the findings. All policies mentioned have been researched in this manner, apart from any others, as relevant.
b. Examples of waste reduction were sought through social media in partnership with relevant networks and agencies and popular hotspots through online means.

3. Are Indians Ready for Waste Reduction?

This study sought to find indication via a KAP (Knowledge, Attitude and Perception) survey amongst residents in five cities - Bengaluru, Kolkata, Bhopal, Ahmedabad and Delhi-about the willingness of urban Indians to reduce their waste. The methodology has been described in the chapter by the same name.

The objectives of the study were:

- To find the general perception of waste management in terms household appliance.
- To understand the knowledge and awareness of waste management in terms of 3Rs and the existing rules. The Solid waste Management Rules were revised in 2016 and introduced 'spot fines for littering and non-segregation of waste into Wet, Dry and Hazardous. Measurement of awareness of these rules and waste disposal practice of the waste generators are important to understand the impact.
- Waste reduction practices and waste reduction services that the respondents were availing of.

3.1 What did people know about waste segregation?

At an overall level, people in Delhi claimed to be practicing segregation the most, followed by Kolkata. In Delhi, the lower-economic strata were more aware of segregation. However, while other cities claimed they did not segregate, everyone was aware about what the term meant. This is key to discussing waste reduction, going ahead.

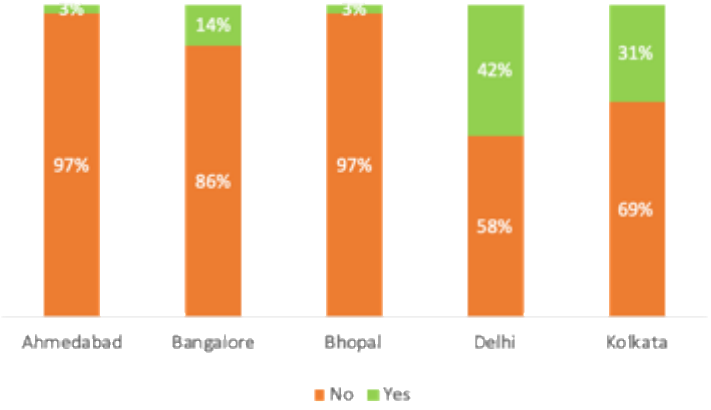

Figure 1: Do you segregate waste before disposing it off?

Slums or rehabilitated housing respondents (n=174)

The maximum knowledge of waste segregation was received from the RWA followed by the *Swachh Bharat Mission* and rest from other sources. The percentage of RWA is highest in Ahmedabad which is 95%, followed by Bhopal which is 78% and Delhi forming 50%. The role of the *Swachh Bharat Mission* is the highest in Kolkata, which is 90%, followed by other cities. In Delhi both RWA (50%) and Swachh Bharat Mission (33%) have reached to the audience.

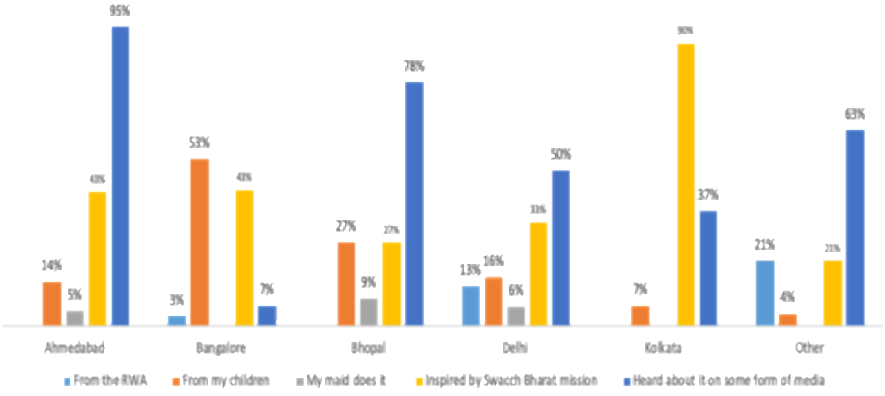

Figure 2: Source of awareness about waste segregation

In case of spreading awareness on the waste management rules, majority of the respondents thinks that it is the Municipality's responsibility to spread awareness about the waste management rules, with Bengaluru (98%), Bhopal (94%), and Kolkata (91%), Ahmedabad (90%). Majority of the respondents believe that the state government can also play a role.

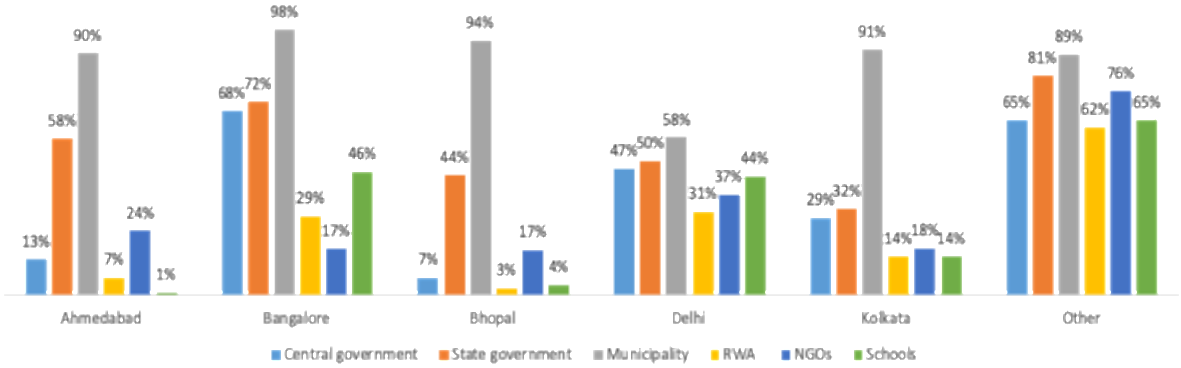

Figure 3: Who do you think is responsible spreading awareness on the waste management rule? (n=670)

In the recent waste management rules there is a provision for imposing penalties to the waste generators for non-compliance. When we tried to understand the awareness of the respondents on penalties, we found respondents from Bhopal (97%), followed by Kolkata and Ahmedabad have the least awareness on penalties for non-compliance of waste management rules whereas respondents from Delhi have the highest level of awareness on the same.

3.2 Awareness of the 3Rs

The awareness of the 3Rs is really high in Delhi (46%) as compared to Bengaluru (31%), Bhopal (12%) and Kolkata (8%). However, it is extremely low in Ahmedabad (1%). However, based on observations and conversations, this is not an accurate description, as eco-friendly practices are key to the lifestyle of many people in Ahmedabad, and hence they don't see this as something unique and worthy of reporting.

Among online respondents, this awareness is slightly high, but it is low among offline respondents.

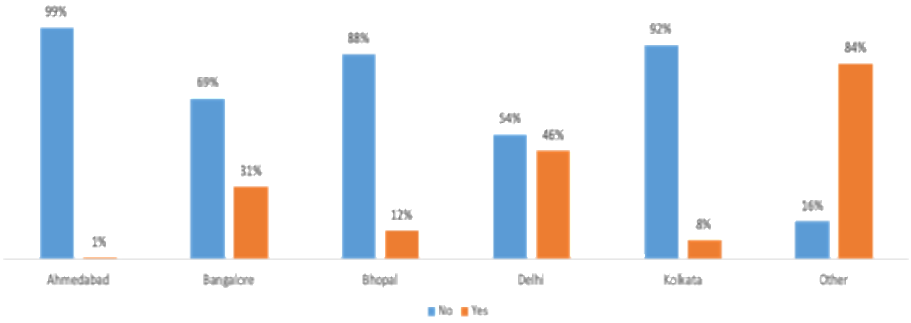

Figure 4: The awareness of 3Rs (n=670)

While sharing an instance for practicing the 3Rs we got some very good input from the respondents primarily from the online respondents of NCR.

- *'Reduce: As much as possible, try to buy non-plastic items.'*
- *'Reuse: Reuse containers, cartons and give old but in good condition clothes to those who can reuse them.'*
- *'Recycle: Segregation, composting at home'*
- *'Reduce the usage of tetra packs by directly taking reusable containers to buy milk from the Mother Diary outlets.'*

Why do they do this?

- *'I believe in living in a pollution-free environment. So, by doing this I can achieve a clean and green environment.'*
- *'Want to reduce use of single-use plastic.'*
- *'General awareness about plastic hazards and traditional habits of recycling.'*
- *'I love nature and want to contribute a bit from my side to preserve it.'*

Why is the practice of 3Rs going down these days?

- *'Probably people are so used to the mentality of the use and throw culture.'*

- *'Lack of facilities for garbage segregation and growing consumerism focusing on use and throw materials.'*
- *'Mainly due to peer pressure and convenience, but also because people feel that things are being recycled anyway, and they do not feel any guilt. There is also the feeling that no one really cares since everything is mixed and dumped. Also, it's an 'out of sight, out of mind' syndrome.'*

Waste reduction priority and availing of waste reduction services

- The survey sought to understand whether waste reduction is a priority in India anymore. 92% - an overwhelming majority - of respondents in Bengaluru pointed out that waste reduction was a priority in modern India. Whereas 87% of Ahmedabad respondents don't think waste reduction is a priority followed by Bhopal (88%) and Kolkata (32%). For respondents in Ahmedabad, eco-friendly practices are key to their lifestyle and hence they don't see this as something different whereas Bengaluru needs more awareness. For Bhopal, it may be that more awareness is needed.

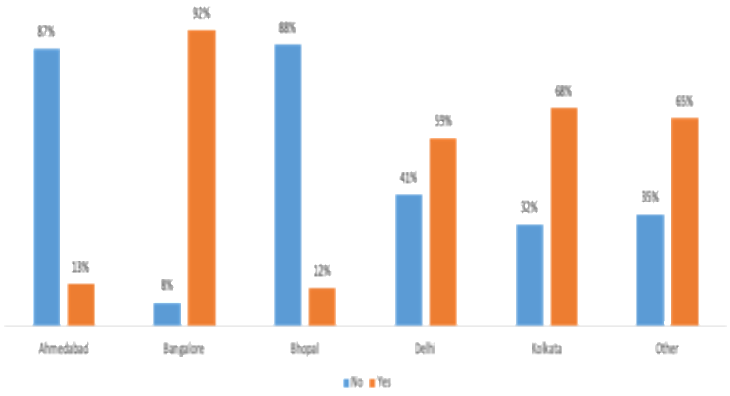

Figure 5: Do you think waste reduction is a priority in modern India? (n=670)

- Majority of the respondents including the online respondents think that the government can play a major role in reducing waste - the highest percentage of those with this response came from Bengaluru(94%), followed by Delhi (67%) and Kolkata (61%).

Related to the use of repair services in last 6 months, a majority of the respondents used repair by tailors as a major service. These included those from Bhopal (65%) and Kolkata (67%), Ahmedabad

(57%), Bengaluru (48%) and Delhi (65%).In Kolkata (72%) and in Ahmedabad (77%) people use the service of the tailor mostly for button/hook repair. They reported using the services of cobblers and utensil repairers, but these were all overshadowed by tailor-based repair. The service of cobblers are mostly used in cities for either polishing or repairing shoes and the least used for repairing other items like leather bags, shoe sole replacement, etc. People use the utensil repair service mostly for repairing of pressure cookers or selling old utensils. Selling and exchanging of old utensils is highest in Ahmedabad (60%) followed by Kolkata (47%), indicating that such a practice is embedded in their life-styles, since they are not overtly reported in this survey by respondents.Most people sell unused household items to '*Kabaddi wallas',* the highest percentage being in Bhopal (95%) and Ahmedabad (89%) whereas in Delhi, people also donate it to needy people. Kolkata reported exchange offers as well.

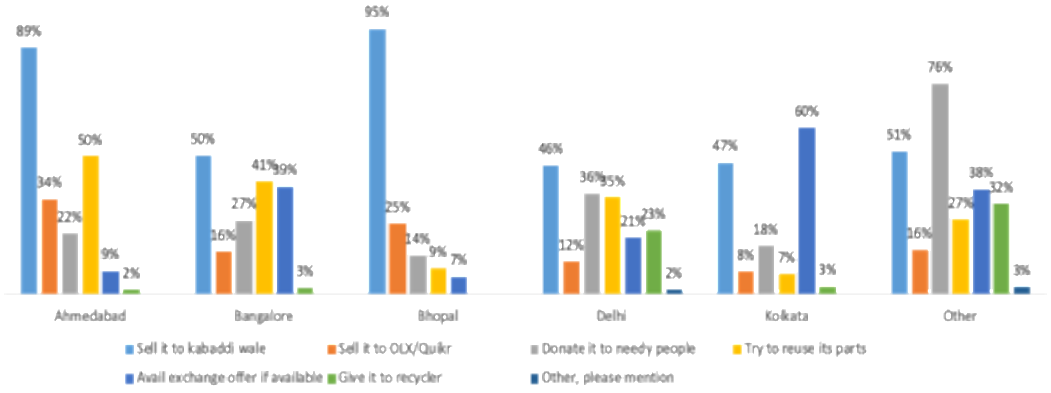

Figure 6: What do you do with any household items which you are not using further? (n=670)

Respondents from cities like Bengaluru (83%), Delhi (62%), Kolkata (68%) and others think that waste reduction requires an element of sacrifice whereas respondents from Ahmedabad (21%) and Bhopal (11%) don't think so. We tried to go deeper to understand the reason behind this thinking and got some responses:

- *'It needs discipline. As I said, everyone puts a premium to their time and mind space. To have more waste reduction, people would need to put in time, attention and effort towards it. It needs effort and conscientious handling. However, once it becomes a habit, it is very easy.'*

- *'Because one has to change one's behaviour. Often times, it is laziness and inconvenience that makes us not reduce our waste. So, for us to reduce our waste, we need to make a concerted effort to change one's behaviour, for example, to always carry a reusable bag so we don't need a plastic bag. Carrying our own reusable straws rather than using plastic ones. Own stainless steel bottle when we travel so we don't have to buy bottled water, etc.'*
- *'It's a continuous and lifelong process hence it requires an element of sacrifice and discipline.'*

The maximum respondents who think that waste reduction requires an element of sacrifice and are willing to make an extra effort to reduce waste were from Bengaluru (100%), followed by Delhi and then Kolkata.

From this survey, we understand that Indians actively believe that waste reduction is an important aspect of their lives, but they do not do enough for it. For example, segregation is poorly implemented in all cities. Yet, service providers, such as tailors and cobblers - informal actors who repair items and prevent them from being wasted - continue to be universally relevant. Indians can therefore be seen as ready for waste reduction but it will have to include a deep-penetrating communication plan with clear messages. This should include those who already practice waste reduction, to encourage them to retain these good practices.

4. Plastics: How to Reduce an Omnipresent Material

The global consumption of plastic accounts is approximately 300 million tons[1] each year with half of it being disposable plastic. As of 2015, only 9%[2] of the globally disposed plastic was recycled. Plastic waste is not only a menace for land waste management but also for riverine system. In a study by Jambeck Research Group in 2015[3], it was revealed 270 million tons of plastic was produced in the year 2010. Coastal plastic waste (waste generated within 50kms of coastal line) was 99.5 million tons. Out of this, 31.9 million tons of plastic waste was accounted as mismanaged waste and approximately 8 million tons of plastic waste was estimated to enter the oceans. As of 2019, this number is estimated to be 12.7 million tonnes[4].

4.1 Global Plastic Waste Reduction Policy

What are the pathways to reduce the use of plastics? Expert opinions suggest that there are at least three ways to a plastic-free world:

- Bans: eliminating the use in its entirety. However, discouraging or limiting access – as in the case of the straw ban - is seldom written into law.
- Charges: levying charges on the use of a certain product. The flip side of charging would be to provide incentives or encouragement of non-usage. CDL (container deposit legislation) is one form of incentives aimed at recycling and not reduction per se. It is effective albeit expensive for implementation (Szura, 2018).
- Recycling: Collecting and recycling the product to ensure lesser amount is mined from the world's depleting oil resources, and extracting more use from the product by keeping it in circulation for longer periods.

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[1] IUCN, Marine Plastics, Issue Brief: https://www.iucn.org/resources/issues-briefs/marine-plastics
[2]Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. Science Advances, 3(7), e1700782.
[3] Jambeck, J.R., Andrady, A., Geyer, R., Narayan, R., Perryman, M., Siegler, T., Wilcox, C., Lavender Law, K. , 2015. Plastic waste inputs from land into the ocean, Science, 347, p. 768-771.
[4] Shamseer Mambra, How is plastic totally ruining the oceans in the worst way possible?: https://www.marineinsight.com/environment/how-is-plastic-ruining-the-ocean/

Banning and charging have become the most popular methods to phase out the use of plastics which has an astounding magnitude -every year, one trillion plastic bags – single use – are used, equating to 2 million per minute (Lober, 2018). Recycling remains on the backburner as it requires a complex system for enabling segregated collection, setting up sorting facilities and recycling infrastructure, allocation of space, and binding legislation on the increased use of recycled content by manufacturers and brand owners. Governments would require taking a systems approach and marrying seemingly unrelated departments; for example, 'Solid Waste Management' and 'Renewable Energy' that must all be aligned towards a common goal. While the solid waste management departments may be more cognizant of the limited scope of incineration as an economically viable disposal mechanism, the department of renewable energy may continue to subsidise incineration projects. While there may be a government emphasis on poverty elevation through livelihood generation, other policies may render thousands in the informal sector without a livelihood with the granting of weight-based waste management contracts to private corporations. This web is also precariously built atop the basic fact that as long as virgin plastic prices remain low, use of recycled content will always remain limited. It may be precisely due to these conditions that environmentalists and governments look at banning and charging as panacea.

The United States

California, in the United States, the state in which Berkley is located, has always been the epicentre of environmental consciousness. Thus, it was no wonder that Berkley upped the ante on the war on plastics. In January 2019, the state passed the Disposable-Free Dining Ordinance- a progressive and bold move. The ordinance goes further than the many disposable plastic reduction ordinances that have passed around the US and globe in the last two years. It requires that:

- Only reusable food ware can be used for dine-in service,
- All takeout food ware must be BPI-certified compostable,
- Food vendors must charge customers $0.25 for every disposable beverage cup, and
- Disposable compostable straws, stirrers, cup spill plugs, napkins and utensils for take-out are provided only upon request by the customer or at a self-serve station.

Background and History

The ordinance cannot be seen in isolation as it has been a slow build- up to this moment. Berkley gave Styrofoam (Expanded Polystyrene or EPS), which is widely used in take-out food containers or as disposable cups, the boot way back in 1988 (came into effect in 1990) due to its use of ozone-depleting Chlorofluorocarbons for expansion. It is true that EPS is a good insulating agent, but that is where its laurels end. EPS is light, foamy and cheap. It is also a mix of natural and synthetic polymers, and almost all EPS remains non-recycled, making its way instead to landfills or worse into waterways or protected lands (Surfrider Foundation, undated).

In the November 2016 elections, 53% voters in California approved Proposition 67 (after the failed prop 65 which only levied charges, but did not ban plastic carry bags) that banned the use of carry bags (or grocery bags) and asked that they be replaced with compostable bags, cloth bags or paper bags. The proposition allows use of plastic bags with at least 20% recycled content in 2016, which would go up to 40% by 2020. This proposition was superseded by ordinances in at least 13 counties and 130 cities in California starting with San Francisco in 2007. (Californians Against Waste, undated).

In 2018, California bid adieu to the use of straws. Carefully worded, the ban on straws applies to all on-site diners and deters default provision of straws to the customers. They can still ask for a straw if desired.

The disposable-free dining ordinance was passed against this long historical backdrop. By passing the Energy Transition for Green Growth Act in 2015, France seemed well on its way to achieve the goal of replacing 17 billion plastic bags with compostable materials, and eliminating almost 5 billion plastic goblets that the French have been sending straight to the landfill (Rupp, 2018). However, the implementation of the act has now been postponed to 2020 as it may be in violation of EU's legislation regarding the free movement of goods and the protection of manufacturers.

Clearly, the goal of these ordinances seems to be the reduced use of plastics which continues to raise questions like, 'Does it reduce the use of plastics?' Many of the ordinances, declarations, bills and regulations appear to be knee jerk reactions to the sudden awareness of ocean pollution.

In October 2019, a visit to San Jose proved the futility of some of these actions, even in California. While several dustbins, including at the San Francisco Airport and in neighbourhoods of San Jose, identified specific bins for biodegradable plastics, each of the biodegradable plastic items had a small disclaimer. The disclaimed read that the plastic could be recycled only in industrial facilities and the recyclability claim was valid only if such a facility was present in the neighbourhood. However, despite calls and several queries, no such facility was identified. In short, the idea of compostable plastic was of no use to reduce or control plastic waste.

Impact of Bans

Do bans work? What conditions need to be met in order for bans to work?
The intended impact of bans is to reduce the use of the banned item. One calculation suggests that a ban on bags across the U.S. could save $3.2 to $7.9 billion in litter control alone. While elimination is the ultimate goal, bans require a set of prerequisite conditions to be even somewhat effective:

- The scope and clarity of the ban

Who is in the scope and who is exempt?

England implemented a ban on plastic bags in 2014 after Ireland's trailblazing bag tax in 2002. Ireland imposed a 5 pence plastic bag levy or a 'carrier levy'. This quickly led to a 90% drop in use of plastic bags, with 100 crore or 1 billion fewer bags used, and it generated 0.96 crore INR or 0.0096 billion USD for a green fund supporting environmental projects. Wales (2011), Northern Ireland (2013) and Scotland (2014) followed. Prior to the ban, England used more than 760 crore or 7.6 billion carry bags, and this number had been on the rise each year until the ban was introduced and implemented in 2015. Post ban, the use of plastic carry bags decreased by 70-80% year on year (Schaverien, 2018) mostly due to the charge of 4.43 INR or 5p per bag. However, the scope of the ban only extended to larger retailers. Medium and small retailers were left out of its purview and continue to give as many as 360 crore INR or 3.6 billion carry bags to customers each year.

Monitoring, tweaking and measuring efficacy: Ireland is a case in point in monitoring the efficacy of bans. A charge of 6.72 INR or $0.14/€0.15 on plastic bags came into effect in 2002 leading to an immediate reduction in usage. However, usage went up after a few years. This was closely monitored, and the charge was increased to 12.4 INR or $0.31/€.22 in 2007 to continue the positive impact of the ban (Summers, 2012).

- Implementation snags

  -Bangladesh was the first country to implement a ban on plastic bags in 2002, mainly to prevent the bags from blocking the sewage system. 9 million plastic bags were estimated to be used in 2002, of which 10% made it to the bins and the other 90% clogged the sewers (Ecospear, 2018). By no means is the high consumption the central issue as Bangladesh consumes 8 kg/year/per capita compared to Singapore that consumes 135kgs (Al Masum Molla, 2018). As part of the ban, the government also levied a fine of $71 and imprisonment of upto 6 months for perpetrators. NGOs and other government forces rallied together to raise awareness of the ban. However, 17 years on, the city of Dhaka continues to be plagued by the scourge of plastic bags due to incompetent implementation of the ban. Environmentalists blame the government for lack of enforcement. Often, perpetrators are let off with a slap on the wrist or worse, freed after receiving a bribe (Mahmud, 2018).

  - China banned the use of plastic bags in 2008. What it banned, in fact, was the giving away of ‘free bags’. The results are divided - One survey found that the number of plastic bags in garbage had reduced by over 10%. It should be mentioned that there was a higher drop of 80% in foreign-invested supermarkets compared to Chinese-owned markets 60% (Hofman, 2018). Another survey conducted by the China Zero Waste Alliance found that 78% retailers were not complying. They were also replacing the banned plastic bag by other equally harmful single-use plastic sheets and wraps (Anon, 2018).

EU's Circular Economy Package

The European Union's vision for a new plastics economy is outlined as follows: 'A smart, innovative and sustainable plastics industry, where design and production fully respects the needs of reuse, repair, and recycling, brings growth and jobs to Europe, and helps cut EU's greenhouse gas emissions and dependence on imported fossil fuels (European Commission, 2019).

Several documents (ibid, European Commission, 2019) outline the commission's ambitious plans and give guidance on how to achieve them:

- Curbing plastic waste and littering and increasing clean collection of plastics is rounded off with a directive (European Union, 2015) that emphasises the reduction of the use of thin plastics, or in fact, of oxo-degradable bags that fragment, but do not biodegrade.
- Better product design is key to moving the needle on circular economy. The union requires 55% of all packaging materials in EU to be recycled by 2025. 'Designing for recyclability' is imperative for increased recycling rates.
- Driving innovation and investment towards circular solutions: This transition will be financially supported by ESIF (European Structural and Investment Funds) funding, 5099.01 crore INR or $0.718 billion/€650million from Horizon 2020 (the EU funding programme for research and innovation), 43145.5 crore INR or $60.8 billion/€5.5 billion from structural funds for waste management, and investments in the circular economy at national level (European Commission, 2015).
- Harnessing global action: the union emphasises that this is not a localised problem and the world will require a trans-boundary commitment to circularity of materials. It also alludes to ensuring that that the same quality of standards is met when waste plastics are sent to other nations for recycling.

While the vision is broad and deep, the package (a number of measures) unveiled in 2018 is an amalgamation of various directives that have been put in place for several preceding decades, and is referred to as comitology (a set of procedures through which EU countries control how the European Commission implements EU law. Broadly speaking, before it can implement an EU legal

act, the Commission must consult, for the detailed implementing measures it proposes, a committee where every EU country is represented).

One measure around the 'eco-design' directive can be evaluated for current or possible impact. First established in 2009, the eco-design directive (European Union, 2009)is a framework to set mandatory ecological requirements for energy-using and energy-related products. Starting with 10 products the directive has now expanded its scope. Although it has had an impact on energy savings, whether it will also impact the resource recovery and recycling is yet to be seen.

Reduction of plastic waste: corporate action

FMCGs (Fast Moving Consumer Goods) are however, beginning to respond to the regulatory pressures. Most of their innovations are related to product design, such as light-weighting or increasing recyclability. Here are some noteworthy innovations:

- Danone, the French company has developed a robust collection and close-loop bottle-to-bottle recycling (Climate Action, undated) in various parts of the world.
- Coca-cola calls their initiative the 'zero-waste cities' where they have collaborated with organizations such as UNDP (India) and Keep America Beautiful (USA). They hope to change people's behavioural patterns to increase recycling (Coca Cola Foundation, undated).
- Unilever has pledged to reduce 30% plastic consumption by weight by 2020. The company is also piloting Loop - a programme in which customers can return packaging for refilling (Uniliver, undated).

With an avalanche of pressures from civil society, activists and the general public who has woken up to the reality that there may be 'more plastic than fish in the ocean by 2050', companies that respond to (a) Regulation and (b) Customer demands, have begun to examine their own role to rein in their addiction to plastics.

Long after plastics were heralded to be the magic material (due to their cost and durability) and PET the king of all plastics (due to its strength, inert quality and resistance to micro-organisms and, in fact, its recyclability), it has come to light that their use or misuse has been ubiquitous. None have

abused it more than the Fast Moving Consumer Goods (FMCG) industry, which moves large single use packaging plastics material across countries and continents. These plastics may contain anything from food to cleaning products. For PET alone, the numbers are both staggering and sobering - 73 million metric tonnes of PET will be produced annually by 2020 (Statista, 2015) up from 41 in 2014. The main use of PET is bottles, and 505 billion units of PET bottles were produced in 2017 with a projected annual growth rate of more than 3% by 2026 (Globe Newswire, 2018). While PET is one of the most recycled materials, the rate is only approx. 30% (Waste360 Staff, 2018).

Any pledges and promises by companies must be evaluated against this backdrop. ASDA, the UK food retailer owned by Walmart announced its plan to reduce 18% plastic usage in 2018, and cut out the use of single-use cups and cutlery in 2019. McDonald's pledges its commitment to use packaging that is renewable, recycled, or sustainably sourcedin the next 8 years. This is no small feat given their 36,000 restaurants globally. Costa Coffee, the world's largest coffee chain with over 3000 stores, is targeting 2020 to recycle half a billion cups with the help of waste workers (they get compensated £70 per ton). Danone, the largest bottled water manufacturer, has finally come back from the dark side and has been selling 100% recycled PET bottle in Indonesia, and by 2025, this will be the norm across the globe (Wentworth, 2018).

Other non-FMCG companies such as Dell, Trek and HP are also quickly jumping on the bandwagon of commitments. Part of the 'next wave', many companies have pledged to reduce the reliance on virgin materials (See Website).[5] HP claims to have recycled more than 170 tonnes of plastic sourced from Haiti (8.3 million plastic bottles) going mostly into printer cartridges (Hewlett Packard, 2019).

The Ellen MacArthur Foundation has been the catalyst to invite, cajole, convince and compel corporations to make their commitments. An impressive 250+ companies have signed up to circular ways of conducting business (eliminate, innovate and circulate).

Ruled by cost and a public image, and forced by various regulations, companies have finally succumbed to at least pledging their way out of negative publicity. It will only be seen in the next

[5]Website of www.nextwaveplastics.org

few years if any of these pledges will be realised, or whether it is another passing wave to assuage and pacify increasingly nervous customers.

4.2 Indian Legislation

The most recent legislation around plastics in India has been the partial plastic ban in the states of Maharashtra, Sikkim and Tamil Nadu, with the view of reducing plastics. This section analyzes their efficacy. India has vowed to abolish single-use plastics by 2023. This move can be informed by the roll-out of these legislations

Introduction

Environmental concerns have caused governments across the world, including many states in India, to limit the use of single-use plastics through a variety of regulatory instruments ranging from explicit levies to total ban on single-use plastics. However, as plastic bans spread around India and the world their effectiveness remains unanswered. Whether plastic bans can significantly reduce plastic waste leaking into oceans at an average rate of eight million tonnes a year, remains to be seen-especially in light of forecast on plastic production which is set to double by 2040 (Haward, 2018).

BOX 1

What's the role of Public Interest Litigations (PILS)?

We examined the active litigation in the National Green Tribunal to understand the orders and their role in reducing. However, it was clear that the cases, even if they ask for bans etc, do not impact waste reduction. Most often, the case is referred to another agency, and orders given to the relevant authorities to follow the law or take action. The cases in the Appendix show that contrary to popular belief, PILs do not play an impactful role in plastic reduction.

This section examines the efficacy of bans in Maharashtra, Tamil Nadu and Sikkim.

Maharashtra

A recent report from Maharashtra reveals that the ban has been able to curb the plastic production by half since its enforcement. While quantitative numbers present an overarching view of the ban, we present, a synthesis of the lived experiences of various stakeholders in three of India's prominent states- Maharashtra, Tamil Nadu and Sikkim that have imposed a ban on single-use plastics. Through their experiences, we hope to zoom into the granular issues and challenges and understand the role of bans in reducing plastics.

Methodology

Three states in India- Sikkim, Maharashtra and Tamil Nadu were chosen as they represent diverse geographic and demographic features. We investigated the efficacy of the ban by chronicling the experiences of the different stakeholders in these states. While the impact of the ban is being determined quantitatively, there is a dearth of accounts of lived-experiences of the different stakeholders who make or break the ban. We identified key informants representing the various stakeholder groups such as public officials, plastic manufacturers and retailers, consumers and campaigners for in-depth interviews through snowball methods. Key Informant Interview (KII) was conducted over a week, on digital medium, where the informants' perceptions on the successes, failures, opportunities and aspirations were recorded. The table below provides a summary of the respondents interviewed in each state.

Table 1: Summary of Interviews with Respondents

Stakeholder Category	**Respondents in Maharashtra**	**Respondents in Sikkim**	**Respondents in Tamil Nadu**
Plastic producers and processors	2	-	1
Public officials	2	3	4
Business owners and retailers	2	-	6
Consumers and campaigners	34	11	24
Total respondents in each state	**40**	**14**	**35**

A basic questionnaire to probe the respondents' first-hand experience with the ban was shared with them. The questionnaire sought to understand the levels and modes of awareness about the ban, the perceptions of successes and failures with detailed reasoning and the aspirations and expectations for the future. This was followed up with telephonic interviews to further our understanding, wherever required. This report encapsulates these experiences with a view to amplify the successes and mitigate the failures in ways that may best benefit the different constituencies.

The report consists of three main sections where the findings and learning from each of the three states chosen are presented. Within each section, an introduction to the basic legislative framework and policy landscape is first set out, followed by a detailed discussion and analysis of the stakeholders' perceptions that seek to inform the way forward, presented in the final sub-section. The report concludes with a comprehensive set of recommendations drawn from the experiences of stakeholders in these three states with bonafide intent to aid policy makers to steer in the right direction to stem the plastic tide.

BOX 2

The challenge of working with the law: Maharashtra

It started off with a bang: In 2016, the Maharashtra Government stated in the plastics waste management rules[6]'The manufacture and use of non-recyclable multilayered plastic, if any, should be phased out in two years' time.' Activists rejoiced at the prospect of the death of this reviled lightweight non-recyclable item from the waste pile.

However, by 2018 the government changed the semantics on this path-breaking regulation by merely changing the placement of 'non-recyclable'.

In rule 9, in sub-rule (3), for the words 'non-recyclable multi-layered plastic if any', there was a substitution of the words 'multi-layered plastic which is non-recyclable or non-energy recoverable or with no alternate use'.

In 2016, it was an adjective, a defining characteristic of multi-layered plastics – non-recyclable - multi-layered plastic. In 2018, it assumed a more lenient view of the material – multi layered plastic which is recyclable – as if there are two kinds of multi-layered plastics – one which is recyclable and

[6]For all rules refer here: http://mpcb.gov.in/plastic/plastic.php

one that is not. Indeed, the amendment to the rules went on to suggest the kinds of multi-layered plastics that can be considered recyclable: those that can produce energy or have alternate uses. It does not matter that neither of these are commercially viable or economically feasible. The price of fuel generated from multi-layered plastic simply does not make it a viable technology to invest in. While 'plastics to fuel' is considered to be recycling as per the Solid Waste Management Rules, 2016, this is a very linear kind of recycling, whereas more circular recycling techniques should be encouraged.

The ban led food manufacturers to scramble to find alternate uses for multi-layered plastics. They are tied into an EPR policy to ensure collection of the plastics.

By 2018, the Government of India and the Maharashtra Government stated that non-recyclable multi-layered plastics should be phased out. Further, '(2) The manufacturer/brand owner/producer of non-recyclable multi-layered and paper-based carton packaging material using one layer of plastic/Manufacturer's Association, shall diligently implement their Extended Producer Responsibility (EPR) Plan which includes coordination/collaboration with existing rag pickers/scrap traders/retailers for collection of plastic waste, and its subsequent recycling and final disposal through their own established recycling plant or registered recyclers by establishing Producer's Responsible Organisations (PRO), which shall be responsible for 100% integral Plastic Waste Management right from collection to final disposal.' The above clause has multiple interpretations: what exactly needs to be phased out- only *non-recyclable* multi-layered plastic? What does the EPR apply to? Are the PROs meant to coordinate collection with a token mention of the informal sector without mandating their inclusion? More recently, the government has also allowed manufacturers and brand owners to institute their own collection systems without requiring the use of a PRO.

Nonetheless, this has decreased plastic waste by 40% as per the government's data. Ongoing efforts of enforcement and an incremental tempering of plastic use, larger budgets for raising awareness and a steady focus on alternatives might make the results more sustainable and long term.

Perceptions of stakeholders on plastic ban in Maharashtra

Concerned by the environmental, economic and public health impacts of plastics, the Government of Maharashtra issued a notification to the Maharashtra Plastic and Thermocol Products (Manufacture, Usage, Sale, Transport, Handling and Storage) on March 23, 2018 (Government of Maharashtra, 2018). In doing so, Maharashtra became the first state in the country to impose a blanket ban on not only plastic carry bags, but also polystyrene and multi-layer packaging. The

notification imposed a ban on the manufacture, usage, transport, distribution, wholesale and retail sales, and storage and import of plastic bags with and without handles, and the disposable products manufactured from plastic and thermocol (polystyrene), such as single-use disposable plastic products used for packaging food in hotels, non-woven polypropylene bags used to store liquid, plastic packaging of fresh food items and food grain material, etc.

The notification was modified on April 11, 2018, and the use of PET bottles was allowed, subject to the condition that PET bottle manufacturers develop a buy-back depository mechanism and ensure collection for recycling by setting up collection centres. The ban was enforced on June 23, 2018, after a preparatory period of three months. Within a week of its enforcement, further concessions were made in the imposition of the ban (The Hindu, 2018). In July 2018, the government issued illustrative pictorial information of the items banned and exempted to remove ambiguities and scope for confusion (Government of Maharashtra, 2018).

As countries around the world and more specifically, the cities in developing countries look for solutions to stem the plastic tide, it may be worthy to look east and learn from measures like the plastic ban in different states and cities in India. If well implemented, bans have the opportunity to tap the problem at its source of origin, i.e. production. If poorly implemented, bans can have significant unintended consequences such as creation of a black market for smuggled plastics, etc. The Plastic ban in Maharashtra offers an excellent lens to evaluate the importance of the ban keeping in mind the necessity and ubiquity of plastics in megacities like Mumbai, and the environmental, economic and public health impacts of poor disposal and management.

Findings

- Awareness and modes of awareness

All the stakeholders interviewed, especially the producers, retailers and consumers were well aware of the enforcement as reflected in the 100% awareness levels of respondents. Almost 64% of the respondents attributed their knowledge of the ban to social media and mass media, especially the newspapers. 10% of the respondents intriguingly attributed their knowledge of the

ban to actual experiences on the ground when they saw plastic bags/cutlery being denied. The levels of awareness and the varied modes of information on the ban reflect the ubiquity of the problem of plastic pollution, as well as the challenge ahead of government and civil societies to provide an enabling environment to beat plastic pollution. In particular, it reflected the strong political will and commitment of the state to get to the root of the plastic problem.

Speaking of the extensive information, education and communication campaign led by the government, the Assistant Commissioner, Municipal Corporation of Greater Mumbai (MCGM), Mr. Kiran Dhigavkar said that the government and the city corporation held massive campaigns to spread awareness on the ban. Mr. Dhigvakar, who is also the Nodal officer for the Swachh Bharat Mission mentioned that the campaign intended to educate people not only on cleanliness, but also on the ill-effects of plastics on the environment and human health.

Dr. Ketaki Ghatge, Medical officer, Pune Municipal Corporation (PMC) stated that the ban was essentially a top-down decision from the government to tackle the environmental crisis caused by single-use plastics. She said that the decision came at the most appropriate time, when municipalities like Mahabaleshwar, Panchagani, Dapoli, etc. had already banned different categories of plastic within their jurisdiction. Dr.Ghatge also mentioned that due to the extensive campaign led by the state government and the urban local bodies, people were very much aware about not only the ban, but also the compelling reasons behind it.

As a run-up to the plastic ban, MCGM (Municipal Corporation of Greater Mumbai) and other local bodies organised huge events or *melas* to sensitise the general public about the importance of the ban and eco-friendly alternatives to the banned plastics. Sarita Nair, a resident of Pune mentioned that ‘the details of the ban were widely publicized to make the citizens aware about the ill-effects of plastics to our health as well as to the environment.’ Vidhya, a resident of Ulwe, Navi Mumbai mentioned that she learnt of the ban when the shopkeepers refused to give plastic carry bags in the local vegetable market. Mr. Ravi. J. Iyer, a caterer and event manager in Nagpur stated that he came to know of the ban through newspapers and social media, but believed it to be true when disposables became scarce and almost unavailable in the markets of Nagpur. Anand Srinivasan, an

event manager and a resident of Ghatkopar said that a huge hoarding about the ban caught his attention first, and he went on to understand the details through newspapers and social media.

According to the Government of Maharashtra, despite the subsistence of the ban on plastic bags of less than 50 microns by virtue of the Maharashtra Plastic Carry Bags (Manufacture and Usage) Rules, 2006, there had been an increase in the non-biodegradable plastic waste causing damage to the environment and public health, besides causing a financial burden to the local bodies. The current ban went a step further by banning all single-use disposables. This was a huge step for the environment and health of the people. As Dr. Ghatge and Mr. Dhigvakar stated, the government had left no stone unturned to spread awareness amongst people, so the common people were aware not only about the notification but also the intent and objectives of the ban. The experiences of the respondents reflected this positive intent of the state.

- Challenges - Converting the intent to action

Deemed as India's largest waste creator for three years in a row by the Ministry of Housing and Urban Affairs (MoHUA), Maharashtra set out to change its fate and took a significant step towards fighting plastic pollution by launching a state-wide plastic ban in June 2018. It has been more than a year since the ban came into force in Maharashtra. While its impacts are still being studied, sustaining the effort over a period of time and building on the positives has been a major challenge as gathered from the interviews.

While the high levels of awareness reflected strong political will, the subsequent amendments diluting the severity led to scepticism amongst the consumers. This was reflected in their responses where nearly 34% of the respondents called the ban a complete failure, while another 19% expressed that the rigour of the ban had fizzled out overtime, tending to its failure. These respondents stated that the ban had appeared to be successful during the first few weeks of enforcement, but fizzled out over time due to lack of stringent monitoring. Nearly 37% of the respondents admitted that the ban was moderately successful since plastic carry bags and cutlery had reduced, but on further probing, they too expressed disappointment over the subsequent amendments.

The consolidated experiences of the respondents point to the lax implementation of the ban in the state. On the one hand, campaigners and manufacturers pointed to the inchoateness of the ban, which had impacted heavily the marginalised and small vendors without penalising huge corporations. On the demand side, the alternatives were inadequate and insufficient to ensure that the banned plastics were substituted with sustainable alternatives.

Ms. Avani Rastogi, a lawyer from Borivali, Mumbai said that in the first few months, due to the fear of penalty, both consumers and retailers exhibited massive behavioural change. She shared that the consumers were seen carrying cloth bags and reusable utensils while the shopkeepers refused to give carry bags. 'Almost a year later, people have now begun going back to their old ways because there is no one checking', she added.

Harshad Barde, a campaigner from Pune said that the ban came across as an extremely successful effort initially because of the clear political will and the formation of a dedicated task force for stringent enforcement. He mentioned that over time, due to the slew of amendments and changes to the ban list, the interest and commitment had started to fade. 'Ad hoc and sporadic enforcement, giving in to selective demands from different stakeholders and the lack of engagement with informal recycling are the main reasons for the diminishing success of the ban', Mr. Barde added.

Benita Chacko, a journalist who covered the plastic ban right from the time the idea was conceived, felt that the government had the right intention but not the right apparatus to implement the ban in full spirit. From her experience of interacting with the stakeholders, she was of the view that the government was not fully ready with an action plan to tackle the ban, especially with respect to the rehabilitation of those whose livelihoods had been jeopardised by the ban. She also cited the frequent amendments by the government making exemptions to items like thermocol for religious activities as a reason for the declining confidence among the general public.

The manufacturing sector, on the other hand, was of the opinion that the implementing machinery of the government was not ready for the ban, casting major aspersions on the intent and objective. Manish Agarwal, proprietor, Vrindavan Plastic Industries, Andheri said that the plastic ban in the

state has heavily impacted the small and medium enterprises based in Maharashtra, and has created a black market for goods coming from Gujarat. Corroborating Mr. Agarwal's observations, Dr.Ghatge said that the absence of a pan India ban has allowed for illegal crossover of plastic items from the neighbouring state of Gujarat which has proved to be a major challenge for the municipalities.

In Meghna Shah's experience, the ban was quite successful at the start in bringing about the much desired behavioural change amongst businesses and consumers. Like other consumers, she stated that the ban had lost its rigour over time.

'When the ban was imposed, it was being followed by almost all, especially the vendors in Bandra market. However, once the ban was softened with the amendments and exemptions, the customers stopped carrying/bringing alternatives. The vendors, at the risk of losing their businesses, started giving carry bags to customers. Today, Bandra market is flooded with plastics as if there were no ban'- Meghna Shah, Consumer, Bandra, Mumbai.

Ravi Iyer, a caterer and event manager from Nagpur believes that the ban is a great step towards ushering in the much-needed change in attitude and behaviour towards plastics. Mr. Iyer said that the replacement of banned plastics with their alternatives in the markets and other places has reposed faith in the intent and objective of the ban. Even with all its inadequacies and teething issues, a few consumers like Mr. Iyer believe that the ban is a great step in addressing the problem of plastic pollution in speed and scale.

Ankita Tiwari, a consumer and resident of Nagpur said that the ban could have been more successful if it had been a gradual one, rather than an overnight ban. '*Even though three months were given for the preparation of the ban to all the stakeholders, when the ban was imposed, it was a rather overnight phenomenon. Instead of going all out on several items at once, the state should have gone about the ban in a phased out manner with clear periodic targets. This could have made the ban more achievable and realistic*', Ms. Tiwari added.

Many consumers felt that one of the biggest shortcomings of the ban was the frequent amendments to the notification and paving the way for exemptions at the behest of some of the dominant and powerful lobbies indicating the politics of priorities. Mr. Barde said the government must cancel exemptions like those given to 250 ml PET bottles, thermocol for festivals, etc. so as to repose faith in the minds of the general public about the seriousness and commitment of the government. 'Unless the government shows its sincerity and seriousness, it cannot inspire other stakeholders to comply with the ban', Mr. Barde added.

The respondents believed that the ban was fundamentally flawed as it targeted the easy and vulnerable businesses such as street vendors and other small businesses while the large corporations and brands were permitted to function as usual. *'If the government is really concerned about the environmental impacts of plastics, it must go after the big businesses that are responsible for putting out a lot of plastic, especially packaging plastics. How is this even fair to the small vendors and street hawkers if we continue to have supermarkets and brands continuing the use of plastic? These multi-layered plastics are single-use too, and impact the environment and public health in the same way as the other plastics do'*, Mr. Bhalero said.

Ms. Sandhya Ramachandran, a resident of Chembur pointed out the deficiencies and loopholes in the ban. 'While carry bags are under check, I still see delivery services using plastic boxes, and these are put in brown paper packages to hide the fact. So, there is still a lot of single-use plastic waste being used in fraudulent ways', she said. *'Unless monitoring becomes stringent and heavy penalties are imposed, businesses will continue to evade their responsibilities or take shortcuts to comply on paper'*, she added.

The state of Maharashtra took a bold decision to ban single-use plastics completely in June 2018. Even though the state prepared a build-up to the ban at least three months prior to the date of its enforcement, the respondents felt that there was an absence of a direction at the start and sustained monitoring through the implementation phase, which has lead to a disruptive environment. The manufacturers and businesses pointed to the lack of time for proper cushioning and realigning of their processes, while the consumers blamed the inconsistencies and subsequent changes for the non-fulfilment of the objectives even after a year.

The plastic ban initiated by the state may not be the first of its kind. Several other Indian states have a ban of some form or the other However, the scale, scope and range of the blanket ban are interesting enough to identify challenges so as to help mitigate the failures and amplify the successes both locally as well as globally.

- *Opportunities - Going beyond the challenges*

The main objective of the plastic ban was to pave way for a cleaner and healthier environment by reducing the excessive dependency on single-use plastics. By virtue of the ban, the state had presented itself with a great opportunity to examine if a ban was enough in itself to meet the larger objectives.

The problem with the ban was that most stakeholders were not entirely sure about what had been banned and what was exempted. This was primarily because of the slew of amendments following the main notification. Having drafted a list of items it sought to ban, the state must have resisted the pressure from the corporations and other lobbies and stuck to the original list. For instance, to recall Styrofoam from the list due to pressure from religious and other groups meant that the government hadn't thought through the ban before the enforcement. Therefore, the ban in Maharashtra in the present form is a missed opportunity to evince the states commitment to attain the objectives it set out to achieve.

Even though the government gave three months from the time of notification to the actual implementation, a longer gestation period could have helped all stakeholders to realign their processes, as in the case of Kenya. When the Government of Kenya announced a ban, it provided a period of six months for manufacturers and businesses to work on a strategy to align with the ban. During this period, the Kenyan government also engaged with these entities to educate them on the potential alternatives to make adaptation quicker and seamless. It is only fair that a state that is three times as denselypopulated as Kenya should have put in thought and more time commensurate with its population and market size.

Public authorities and domestic manufacturers have expressed their concern over the proliferation of illegal plastics from neighbouring states such as Gujarat and Madhya Pradesh. The emergence of a lucrative black market could have been avoided had the ban been brought across the country at the same time. In the absence of a national ban, the state should have raised a vigilant firewall against the illegal goods from the neighbouring states.

Lessons from Maharashtra

Today, the challenge of plastic pollution goes beyond the conventional single-use items like carry bags and cutlery. Phasing out plastics in a way that works effectively involves many steps of which a ban may be the easiest and may strike at the root of the problem. While currently Maharashtra may be in the right direction with respect to the first step, the missed opportunities (identified in the previous sections) must be rectified immediately to achieve its objectives.

A glaring hole in the fight against plastic pollution is the fact that packaging items, especially those used in Fast Moving Consumer Goods (FMCG) industries have been left out of the ban. The plastic ban is an excellent opportunity to achieve phasing out of multi-layered packaging as per the Plastic Waste Management Rules, 2016. However, these rules have been diluted, leaving the ban inchoate and inadequate as pointed out by many respondents. Multi-layered plastics as we know today find no economic appeal among the waste pickers due to the lack of recycling value. The only way to phase them out is through stringent EPR measures where the companies might be forced to invest in developing alternatives for their packaging or delivery systems.

Unlike in the case of Tamil Nadu, it doesn't seem that the Government of Maharashtra considered the alternatives for the banned plastics. It has also been the criticism of the manufacturing industry that the state did very little to aid the rehabilitation of those who lost their jobs in the plastic and allied sectors. A comprehensive action plan integrating the alternative markets and plastic industry could have helped bridge the demand from the industry for job alternatives and supply of cheap and scalable alternatives.

Lastly, it is common place knowledge that plastic bans themselves do not address the larger problem of waste disposal and are not a substitute to effective waste management systems. The ban is intended for the limited purpose of eliminating single-use plastics that cause negative impacts to public health and the environment. One way of achieving this is by putting the onus on consumers and municipal authorities to reduce the waste generated at source by the effective implementation of Solid Waste Management Rules 2016. These rules mandate source segregation and de-centralisation. If this has to be achieved, the local bodies must focus on reducing the waste at the source. Having enforced the ban, the government must not lose the golden opportunity to integrate it with the principles of the Solid Waste Management Rules and leverage the momentum to work towards a holistic waste management system.

If the Government of Maharashtra is to fight plastic pollution, it needs to alter the behaviour of the stakeholders and not just their preferences. This involves strict fines and micro-monitoring for behavioural interventions such as pro-environmental and pro-health nudges (Chakravarty, 2018) and stringent implementation of Extended Producer Responsibility (EPR). While green nudges involve massive coordination and cohesiveness to make alternatives visible, EPR strikes at the very root of the plastic pollution by making the polluters take ownership for the materials that are produced to be disposed.

Perceptions of stakeholders on the plastic ban in Sikkim

Sikkim is the least populous and second smallest among the states of India. Nestled in the Himalayas, Sikkim borders with Tibet in the north and northeast, Bhutan in the east, Nepal in the west and the state of West Bengal in the south. As host to the Kanchenjunga, the highest peak in India, Sikkim is notable for its biodiversity.

In the late 1990s, during a heavy downpour, plastic carry bags were washed down, causing blockage in the drains that resulted in a huge landslide. Alarmed by the ecological damage caused by plastics, the state government banned plastic bags in 1998. Over the years though, Sikkim, like the rest of the country and the world experienced burgeoning consumerism and with that, a plastic tide. With

linear consumption and disposal, Sikkim has already stretched its limit for landfilling. New landfills are neither possible nor permissible given its fragile ecosystem.

In 2016, concerned by the rampant use and disposal of plastics, the public health impacts and the cost of management of waste to the municipal bodies, the government banned Styrofoam in the state. Concurrently, recognising the impacts of rampant use and disposal of packaged water, the government banned the use of packaged and bottled drinking water in government functions. Vide the notification banning the packaged water it also encouraged the use of filtered and treated drinking water in reusable bottles in government meetings.

Even though the measures are incommensurate with the enormity of the problems faced by the state, Sikkim has been the poster child of environmental sustainability for years. As soon as the plastic ban was announced in the state of Maharashtra, it was proposed that the corporators of Brihanmumbai Municipal Corporation (BMC) visit Sikkim to learn from its experience (Times of India, 2018). If Sikkim's efforts are indeed as successful and praiseworthy, they deserve to be amplified.

Studies by the NGO Toxics Link and eCoexist conducted in 2014 and 2018, respectively, have shown that despite the continued use of plastic bags, Sikkim has fared quite well in the implementation of its green policies. eCoexist's study found that around 66% of shops in Sikkim used paper bags or newspapers and around 34%used plastic bags, which includes non-woven bags. The 2014 study found that nearly 17%of the total waste generated in Sikkim comprised plastic. More profoundly, in a study conducted by Eco-tourism and Conservation Society of Sikkim (ECOSS) for the Zero Waste Himalayas group, it was estimated that extruded food—instant noodles, chips and various forms of potato-based snacks consumed in the state—alone generated 3.47 crore pieces of plastic packaging waste (Toxics Link, 2014).

Findings

- On awareness and modes of awareness

All the consumers and public officials interviewed revealed the presence of high levels of awareness and environmental consciousness amongst the people of Sikkim. While 73% of the consumers attributed their knowledge and awareness about the ban to social media and mass media, the government has had an important role to play in actively spreading awareness, added the government officials. Ms. Usha Lachungpa, Retd. Chief Research Officer, State Forest, Environment and Wildlife Ministry, said that the state of Sikkim was immensely successful in creating pride around the values of conservation and sustainability. 'A huge step in the endeavour was getting all the stakeholders onboard. Years ago, vendors in the market would proudly display their brown covers and boards suggesting the non-availability of plastic carry bags. Even tourists were refused plastic carry bags in the main markets of Gangtok. Such was the pride associated with being environmentally conscious and aware. Over the years though, this value had disintegrated', Ms. Lachungpa said.

Mr. K. Tonyot, a student from Shyari in Sikkim shared that he came to know about the ban through his friends when he volunteered for a clean-up activity. But the reality is divorced from the ban on paper, he added. *`I feel like there has been no ban because if there had been one, I would've come to know about it earlier and I would've noticed the changes taking place around me. There may be a few places that do follow the laws, but I am yet to experience this to believe that it is indeed true. I have not personally seen any place where the bags are completely out of circulation or use'*, Mr. Tonyot added.

Mr. Karma Choden Bhutia, a teacher from Gyalshing, West Sikkim said that there was no symptom of a carry bag ban in his region because of the ubiquity and ease of availability of such bags. On the other hand, Mr. Lakpa Thuten Sherpa, a resident of 6th Mile Tandong in Gangtok, said that he came to know about the ban 'when restaurants and shops in Gangtok stopped using plastic bags and Styrofoam cutlery.'

Ms. Uden Bhutia, campaigner and founder of Khangchendzonga Conservation Committee (KCC), Yuksam said that even before a state-wide ban was instituted, several Gram Panchayats in Sikkim had banned plastic within their jurisdiction to preserve the pristine environment in the rural areas. Mr. Rajendra, P. Gurung, CEO and Founder of Eco-tourism & Conservation Society of Sikkim added

that several schools across Sikkim discouraged students from bringing packaged food and snacks to address the twin problems of malnutrition and plastic packaging waste. More recently, he said, abhorred by the problem of packaged drinking water, the people of Lachung and Lachen took the matters in their own hands and instituted their own ban on packaged water. 'Voluntarily and actively owned and led by the denizens of Lachung and Lachen, local cab drivers, tour guides, holiday homes and hotel owners collectively stop tourists from entering with packaged water. They levy fines on the tourists if they see them with bottles. This sends out a huge message to the tourists who come to Lachung and Lachen in particular', Mr. Gurung said.

Mr.Sonem ChopelBhutia, the Deputy Commissioner of Gangtok Municipal Corporation said that special training wasbeing given to tourist cab drivers, operators and hotel owners to sensitise the incoming tourists to adhere to the ban in the state.

Ms. Lachungpa added that the core of the message on the ban rested on asking people not to use a certain thing without giving them enough reasons behind such a rule. *'Since our values have changed over the years, it is important to instil that long lost pride once again. Minimalism and sustainable lifestyles have to be made glamorous to ensure that we don't need any more clean-ups. If we are serious about preserving our natural heritage, this is the kind of awareness we must spread in the age of rampant consumerism'*, the former Chief Research Officer added. Concerned by the amount of plastics generated in places of worship like monasteries, where branded and unbranded plastics are transacted in thousands every day, Ms. Lachungpa also adduced the importance of educating religious institutions and leaders to address the issue.

In Sikkim, as we understand, there is no dearth of awareness or pride amongst the people about their efforts to preserve and sustain their environment and wilderness. The government must leverage this spirit and step up efforts to address the problem of waste that is currently in crisis proportion as observed by consumers, public officials and campaigners alike.

- Challenges: Converting laws into actions

Campaigners who comprised nearly 30% of the respondents said that the biggest challenge accompanying the carry bag ban was the pervasive proliferation of non-woven polypropylene bags (PP bags) passed off as cloth bags in most markets, complexes and other places. Animesh Gautam, a volunteer with Zero Waste Himalayas observed that the impact of the ban had been reversed with the massive spread of PP bags which were much more harmful than the regular plastic carry bags.

'While the move to ban plastic carry bags was timely and bold, there are loopholes. The banning of plastic bags has been followed by the introduction of PP bags which is not considered as plastic by the common citizens. This has to be clarified in the notification and rectified immediately. In recent times, plastic bags have also been making a comeback in local haats and vegetable markets. This has the potential to reverse the impact achieved by the bag ban all these years'- Animesh Gautam, Volunteer, Zero Waste Himalayas.

Corroborating Mr. Gautam's observations, Mr. Gurung said that the reality of the plastic ban in the state is the rampant replacement of banned transparent bags with PP bags due to lack of awareness and sometimes wantonly as there was no embargo on such bags. In addition, he said, *'Wayside vendors, hawkers who sell fish, meat and chicken and other food sellers surreptitiously stock bags and Styrofoam cutlery and hand it out to the customers voluntarily or on demand.'*

These campaigners also pointed to the rampant proliferation of bin liners, essentially a type of plastic bag. *'While tourism contributes immensely to the local economy in Sikkim, it is leading to a major environmental breakdown in the form of black bin liners. Even though a sanitary landfill was built in Gangtok with international funding, it has turned into a dumpyard for bin liners filled with mixed waste'*, Mr. Gurung said. Through ECOSS, Mr. Gurung and his fellow campaigners are trying to educate home stay and hotel owners all across Sikkim on this menace. Even though plastic bin liners and PP bags are different types of plastic bags, the current ban on bags does not include them. *'There is an urgent need to recognise the environmental and social cost that comes with using PP bags and bin liners and ban them with immediate effect'*, Ms. Bhutia said.

On the problem of lack of inexpensive and sustainable alternatives, Mr. ChopelBhutia added that the traditional snacks and cuisine sold in local bazaars continue to be sold in plastic or Styrofoam cutlery. *'The lack of cheap and credible alternatives to hold the traditional snack made of rice grains and flour, a kind of sweetmeat, forces the vendors to use plastic cutlery. The Gangtok Municipal Corporation has been sensitising them on the health and environmental impacts of plastic cutlery. We are pushing them to shift to hard, reusable plastics, but they are very expensive. We have managed to convert nearly 70% of the city. 30% is a challenge due to the lack of alternatives'*, the Deputy Commissioner added.

Mikal Lepcha, a resident of Upper Sichery in Gangtok said that a combination of factors- lack of serious enforcement by the government and the apathy of the common public - has led to the banned items returning to the market. Ms. Lachungpa added that a wave of new culture such as e-commerce, rising aspirations around material possessions and changed perceptions around sophistication has led to the emergence of more problematic plastics in the market. Tetra packs, PP bags and other packaging waste form the bulk of the waste in the cities and forests of Sikkim, she added.

On the positive impacts of the ban, Mr. Lakpa Thuten said that there was an emerging interest in following plastic-free and zero waste lifestyle which must be capitalised by the government. *'People try to follow trends such as plastic-free living and zero-waste lifestyles, and unknowingly they are avoiding plastics bottles by carrying their own bottles just to look fashionable. I see people carrying their own cloth bags and demanding brown paper bags in the markets. So it is leading to a positive impact. The government must build on this interest to make the ban successful'*, Mr. Thuten added.

The state government and several Gram Panchayats in the state have set an example by banning packaged water for their functions. *'Even though the ban is restricted to government functions, the state must be commended for leading by example. This is a powerful message with the potential to inspire many individuals and organisations'*, Ms. Lachungpa said. *'The government must think of more such measures to curb the plastic pollution and restore the pristine state of Sikkim'*, she added.

- Opportunities : Going beyond the challenges

One of the major issues facing the state is the packaging plastics from Fast Moving Consumer Goods (FMCG) and e-commerce businesses. Campaigners and public authorities alike expressed helplessness over the multi-layer plastics generated by large corporations.

Despite the efforts to make the stakeholders aware of the scale and scope of the plastic problem, the local bodies have to deal with huge amounts of packaging waste from food, fashion, personal hygiene and other consumer goods. *'Even though we are continuously educating the citizens about the ill-effects of rampant use of plastics, we are unable to do anything about the packaging waste generated in super markets. Unless we have nation-wide Extended Producer Responsibility (EPR) laws, it may be impossible to tap the problem at its source. As a municipal corporation, our powers are limited to delivering SWM services in the city'*, Mr. ChopelBhutia said.

'The units manufacturing packaging plastics are not situated within Sikkim, so no action can be sustained against them. Unless we have a national EPR policy in place, getting the businesses to change their behaviour and packaging materials may not be possible', Mr. ChopelBhutia added. Dr. Gopal Pradhan, Member Secretary, Sikkim Pollution Control Board echoed Mr. ChopelBhutia's views on the need for a stringent EPR policy. *'Sikkim state merely consumes the materials produced in other parts of the country and the world. Since we are a mountainous state with a fragile ecosystem, we do not have many manufacturing units. So getting the businesses to account for the waste they produce is beyond our scope. A national EPR policy is the only solution'*, Dr. Pradhan added.

Ms. Uden Bhutia said that her organisation KCC has worked for years to institute urban and rural waste management policies in the state. 'We have several innovative policies such as zero waste trekking trails with low cost and long term solutions to maintain the pristine nature of the Kanchenjunga region. In addition to this, we have piloted the working of Resource Recovery Centres (RRCs) in several Gram Panchayats. I feel that a lot of these efforts are disaggregated. The government must bring all the stakeholders under an umbrella, leverage these efforts and scale them up', she added.

Reiterating Ms. Uden Bhutia's views, Mr. Gurung said that the current measures taken by the government of Sikkim are not commensurate with the problem at hand. *'While the efforts are important, they are inadequate given the changing dynamics, scale, scope and speed of the problem'*, he said. Plastic ban is important, but efforts to restore the serenity, beauty and tranquility of the state go beyond just bans. 'The state must focus on moving up the waste hierarchy. Reducing the waste generated must be the way forward. Dumping must be replaced by segregated source collection, recycling and resource recovery through methods like composting. A holistic environment will automatically pave way for the success of the ban. Currently, there is a lack of an enabling environment for the success of the ban', Mr. Gurung stated.

Dr. Pradhan also enunciated the importance of source segregation to solve the waste crisis in Sikkim. 'The state pollution control board, along with local bodies, holds major drives and awareness activities to promote segregation at source. The state has also banned burning of tyres recently. We have instituted buy-back for milk packets through the local dairy cooperatives. We have been working on creating an enabling environment to maintain a healthy environment and citizenry', he added.

Lessons from Sikkim

Although Sikkim was one of the first states in India to ban plastic bags as an aftermath of a severe environmental crisis caused by plastics choking the drains and waterways, in 2016, the statehad to issue notifications banning another category of problematic plastics. With high levels of consciousness and awareness, Sikkim could have prevented the proliferation of these materials in the first place. Sikkim needs to reassess quickly why it has been unable to achieve the environmental standards it set for itself as early as in 1998. Some of the learning drawn from Sikkim's experience is enlisted below:

- A large part of the problem in Sikkim, like other states and cities in India and around the world is contributed by the proliferation of packaging plastics which puts a huge financial and environmental burden on the local bodies. Unless manufacturers are made

accountable for the waste they produce through a national or a global EPR framework, our cities and states will continue to be thrust with materials problematic to human health and environment.

- Like other cities and states, consumers and businesses in Sikkim are ready to make the switch from single-use disposables. Due to prohibitive costs of the alternatives, businesses often relapse into illegal ways of procuring banned goods. The government, like it has demonstrated in the case of packaged water ban for official functions, must subsidise and promote the availability and use of reusable cutlery, bags and other alternatives. Traditional cottage industries must be revived and renewed as a potential avenue for the production and manufacture of sustainable and eco-friendly alternatives.
- Even though Sikkim narrowly escaped the embarrassment before the National Green Tribunal and submitted its action plan under the Plastic Waste Management Rules, 2016, the implementation has been lax (Press Trust of India, 2019). Slack enforcement has been a recurring problem observed across states and cities in India in matters spanning environment, health and resource conservation. Strict implementation without fear or favour is the need of the hour to address urgent problem like plastic pollution. States and cities cannot afford to be casual and lax in their outreach and implementation.
- Lastly, the fundamental premise on which efforts like bans rest is the need for reducing the waste generated at source. Unless source segregation is carried out strictly, Sikkim will be forced to encroach upon forests to dump its waste. While efforts towards this are being carried out in silos by various local bodies and voluntary organisations, this must be done on a war footing under the stewardship of the government. Unless source segregation and de-centralised waste management systems are made mandatory and enforced strictly, Sikkim will be the home of waste mountains against the backdrop of the pristine of the Great Himalayan range.

Perceptions of stakeholders on the plastic ban in Tamil Nadu

In June 2018, the Chief Minister of Tamil Nadu announced a ban on ‘one time use and throw away plastics’, with a view to make Tamil Nadu a plastic-free state(Government of Tamil Nadu, 2018). Iterating the importance of a good and healthy environment for development and well-being of the

people, the Chief Minister pointed out the negative impacts caused by single-use plastics to the environment and public health. He urged the assembly and the public to join the biggest battle against the plastic menace starting 1stJanuary, 2019.

After a preparatory period of about six months given to all the stakeholders comprising manufacturers, industries, institutions, traders and the public for a life without use and throw away plastics, the ban came into effect on 1st January 2019 (Government of Tamil Nadu, 2019). In December 2018, the state government released a descriptive list of 14 items that were sought to be banned. In addition, the state also recommended eco-friendly alternatives to make the switch easier (Government of Tamil Nadu, 2018). An official circular also added that a committee constituted by the former Chief Minister Ms. J. Jayalalitha to study the effects of single-use plastics on the environment and propose alternatives that can be natively sourced and produced helped create the ban list with a corresponding set of alternatives.

Findings

- On awareness and modes of awareness

Almost all individuals interviewed were aware of the enforcement and were fairly conversant with the banned items. The most popular modes of awareness included social media and mass media like newspapers and televisions at 79%. A couple of small-time vendors attributed their knowledge of the ban to state action like seizure of banned plastics in the local market. One consumer respondent attributed her awareness to the optics of *'stocks of alternatives such as brown paper bags, cloth bags and reusable gunny bags in the local vegetable market which was notorious for stocking bales of plastic bags and pouches for vegetables, fruits and flowers.'* Another respondent said that his faith in the actual implementation of the ban was 'reposed when food-delivery business *Swiggy* delivered his food in a brown paper bag with a wooden spoon.'

As a run-up to the plastic ban, several newspapers, news channels and vernacular radio channels dedicated exclusive space to stories on the plastic ban. Popular national dailies such as the Hindu (The Hindu Net Desk, 2018) and The Times of India (Gautham, 2018), carried useful columns to help

people switch to eco-friendly alternatives, lead zero-waste lifestyles, while vernacular FM stations like Big FM did a mega countdown to the ban on their 'plastic marathon show', urging people to think about alternatives and reminding them of a life before the advent of single-use disposables.

While most urban respondents reported that information reached them at their doorstop or through their handheld devices, a couple of small business owners in rural or peri-urban areas stated that they had proactively looked for information on the ban, especially the alternatives since their livelihoods depended on plastics. Dr. Ranjitha, a resident of Thiruvallur district said her family began to proactively follow the news on the ban and collect all possible information since their subsistence depended on the provision shop run by her father, where carry bags and other plastic disposables were in huge demand.

Mr. Mani, a 42 year old businessman who runs a dry cleaning outlet in Chennai said he was made aware of the ban through the door-to-door campaign conducted by the officials of Greater Chennai Corporation (GCC). He added that a community animator explained the adverse impacts of single-use plastics and urged him to switch to sustainable alternatives for packaging dry-cleaned clothes.

Speaking of the awareness, the MLA of Mylapore Constituency, Mr. Natraj IPS (Retd.) said that the government had been spreading a lot of awareness to help all stakeholders- consumers and small business owners -to cope with the sudden change in their lives. He said that the government's move of banning single-use plastics within its premises and within each department was a welcome step and a statement to motivate people to comply with the ban.

'Charity begins at home; so does cleanliness. The government has set a good example for the people by following what it preaches when it comes to plastic ban. This is a good way to spread awareness.'- Mr. Natraj IPS (Retd.), MLA, Mylapore Constituency.

Spreading awareness on the ban is high on the government's agenda. Following the ban notification, in July, the government vide notification, G.O (2D) No. 30, sanctioned INR 54 lakh *'to take forward the movement of plastic-free Tamil Nadu in a successful manner by creating awareness amongst all stakeholders and finding a substitute for the banned plastic items'.* The

government proposed to hold several regional workshops involving government departments, industries, business association and NGOs.

Even though there is no dearth of information in the age and time of social media, most respondents relied on actual instances of behavioural change experienced or perceived by them to be doubly sure of the existence of the ban. This reinforces the idea that 'seeing is believing' and in order for the initiative to be successful, it must not only be done, but must be seen to be done.

- Challenges : Doing Vs. Doing Effectively

While 33% of the respondents called the ban an outright failure, 16% of the respondents stated that the ban appeared successful due to the visible transformation in the declining use of plastic carry-bags. Almost 51% of the respondents expressed reservations on the success of the ban due to dwindling rigour and the continued availability of banned items in the market. Nearly 24% of the respondents stated that out of the 14 items listed in the notification, at least a few like plastic carry bags and cutlery had begun to be replaced by eco-friendly alternatives.

Sumana Narayanan, an ecologist from Chennai welcomed the efforts put in by consumers and businesses to switch to the alternatives as a result of the ban. She said that she saw great potential in the ban to bring about the much desired behavioural change in the consumption patterns of the society. She added that she feared that the lack of stringent monitoring may lead to slipping back into old habits as has been observed in several parts of the state. Kishore Kumar, an urban planner in Coimbatore shared the same predicament. He substantiated that as a result of poor monitoring and implementation, a lot of vendors in wholesale markets of Coimbatore had gone back to trading and retailing in disposable plastics that feature in the ban list. Senthil Kumar, a PhD scholar from Thiruvannamalai district attributed the withering enthusiasm around the ban to the absence of a sustained and an economically viable supply of alternatives.

It appeared that within a few weeks, the ban was relaxed on the request of retailers in markets to exhaust the stock of plastics available with them, as reported by some of the respondents, and corroborated by a first-hand account from a vendor. S. Thimmirayyan, 56, a vegetable vendor in

Chennai's T.Nagar market said that during the first week of the ban, the corporation conducted a raid and seized all plastic carry bags. Following this, the vendors refused to provide carry bags to customers. As a result, those customers who had not adapted to bringing their own bags were forced to buy a new bag from one of the shops that stocked reusable bags. Some of them returned empty handed unwilling to pay few extra bucks for the bag. This put the sales under enormous pressure and the vendors collectively requested for a relaxation of the ban for a few days. Thimmirayyan, along with other vendors blamed the failure on consumers' apathy. Clearly, the optics of the sustained use or proliferation of the banned items in the market had led to a major disappointment amongst the otherwise enthusiastic consumers, as gathered from the interviews.

Public officials interviewed echoed the sentiments of some of the respondents that enforcement is key. District Collector of the Nilgiris, Ms. Innocent Divya IAS, stated categorically that there was no substitute to stringent enforcement if one was serious about the intent and the cause. She added that the Nilgiris district had leap-frogged further by banning 18 items owing to its special status as a biosphere reserve and the damage to its fragile ecosystem caused by the unchecked use of plastics. The collector attributed the success of the ban in this region to consistent monitoring by flying squads, fear of prohibitively high amounts of fine and voluntary participation from the community members.

A few respondents called the ban 'arbitrary' because of the selective sanction it propagated, targeting especially the poor hawkers and vendors. Speaking on behalf of those whose subsistence depended on their small businesses, which in turn depended on plastics, Vamsi Shankar, an urban governance researcher in Chennai stated that the ban list had items that most affected small-timers like coconut vendors, flower sellers, while leaving out multi-layer plastics manufactured and sold by huge corporations.

'The ban is inchoate and inequitable since it penalises small vendors and businesses, while the multi-nationals that continue to manufacture and trade their goods in more harmful plastics are left unscathed by the ban. Several waste and plastic audits have exposed the ugly side of the plastics manufactured by global companies and their brands. Although they form a huge part of the single-use throwaway plastics, these items are exempt from the list. How is this going to make people

believe that the government is committed to eradicating single-use plastics?'- Vamsi Shankar, 32, Researcher, Chennai.

Sarumathy, 23, a sustainable menstruation practitioner and educator from Chennai also echoed this sentiment. Calling it an environmental and social double-standard, she said that unless the government started taking on the big businesses, the ban may not meet its objective of eradicating 'single-use throwaway plastics'. She also called out on the loss of livelihoods for both the small-plastic manufacturers and other people whose subsistence depended on plastics.

Reiterating Ms. Sarumathy's observations on livelihoods, Mr. G. Shankaran, President, Tamil Nadu, Pondy Plastic Association said that the ban had led to severe economic meltdown in nearly five lakh families that directly or indirectly depend on plastics. *'Almost 2000 units registered as small-scale or medium-scale enterprises that were already burdened with loans have been shut down with no rehabilitative measures or packages offered by the government. Banned plastics make their way into Tamil Nadu from the neighbouring states anyway. The ban has only created a black market for the plastics', he added. 'The onus of finding the right technologies and better materials for the environment should be put on the large corporations through their Research and Development teams. As small businesses, we will adapt that technology, but we cannot invent alternatives to plastics'*, he said, on the question of alternatives and rehabilitation of the workers involved in the plastic industry.

- Opportunities: Has the state seized them or have they ceased to exist?

Nearly 26% of the respondents stated that they were unable to call the ban successful due to the lack of sustained monitoring and stringent action, while another 26% attributed this to the lack of credible and sustained alternatives in the market.

S. Arasiammal, 46, a flower vendor in Chennai's Koyambedu wholesale flower market said that the flowers continued to be retailed in plastic covers of all sizes due to the lack of alternatives or high cost of other reusable packaging materials. *'I sell flowers to retail vendors in plastic covers only. I don't have a choice. Neither do I know what the alternatives are that can keep the flowers*

*fresh',*Arasiammal said. While reasonable exemption has been given to some sections of the society it is creating an optic of failure on the ground as people see the banned items in circulation in the state. Ane Bakiyanathan, 32, an entrepreneur from Pudukottai district said that she had witnessed a massive inflow of all the banned items in the market of Pudukottai. *'I had been to a wedding recently and I saw all the banned plastic items being put to use. Water was served in plastic glasses, plastic cutlery was abundant and plastic liners were used in the dining. How am I to believe that these items have been banned if I can see them in circulation so easily?'* she exclaimed.

Most respondents, including the public officials stated that if the government was serious about the ban, monitoring and implementation at war footing was the way to go. But this is fraught with its share of challenges as abstracted by some of the public officials themselves.

'We conduct regular checks and raids and seize the banned materials if we find them in the shops and markets, However, people are unwilling to give up on convenience despite all the awareness and sensitisation provided to them. As a result, traders are forced to stock the banned plastics. We have to balance the push backs from the vendors and the apathy of the general public', said one of the officials of Greater Chennai Corporation (GCC) who wished to remain anonymous.

Former Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB), Mr. K. Karthikeyan said that in addition to monitoring, the board is also confronted with the challenge of dealing with the plastic waste that is seized. In partnership with GCC and other regional plastic manufacturer's association, the board is overseeing the establishment of plastic waste collection centres with shredders and testing out technologies for co-processing of plastic waste. Mr. Karthikeyan currently heads the Centre of Excellence in Urban Solid Waste Management and works at the intersection of technology and policies around solid waste management.

'While the ban is important, a lot of interests, especially livelihoods are at stake. The board is trying its best to reconcile the interests of all the stakeholders concerned.'- Mr. K. Karthikeyan, Former Member Secretary, TNPCB.

Implementation of the Solid Waste Management Rules in letter and spirit is precursor to the success of the plastic ban, say environmentalists and waste campaigners, a small segment among the consumer-respondents. Under the Plastic Waste Management Rules, the Urban Development Secretary in each state is mandated to produce a monthly report on how much plastic waste is collected, including details of the types of disposal methods*. 'Such compulsory disclosure norms will put pressure on public authorities, including the state pollution control boards'*, said Srini Swamithan, a waste campaigner and a blogger from Chennai.

'Segregation at source is very slack in the state. There is neither an incentive to segregate, nor a disincentive for dumping mixed waste. Unless waste segregation is strictly enforced at source, recovery of plastics may not be possible', said Mr. Natrajan, Founder, Namma Ooru Foundation, a voluntary organisation in Chennai that works on mitigating the environmental impacts of planning and development. *'So, as long as the waste continues to be dumped unsegregated, we may not be able to truly measure the impact of the ban'*, Mr. Natrajan added.

Like Mr. Natrajan, a lot of campaigners believe that the plastic ban cannot subsist or succeed in isolation. In order for it to be fully successful and meet the intended objectives, mandatory source segregation must be enforced with a renewed vigour. '*Our focus must be to move up the waste hierarchy, where we look at reducing the waste we generate at source rather than worry about disposing it. Efforts like bans definitely help us by creating an opportunity and enthusiasm around reducing the waste that is non-compostable or non-recyclable, but unless we segregate our waste, the impacts of a ban may never be fully felt or understood*', says Mr. Viji Ganesh, a campaigner and a volunteer with Namma Ooru Foundation.

Speaking from her experience of handling and processing dry waste from two zones in the city, Ms. Priyadharshini, founder and CEO, Wastewinn Foundation, said that the ban had led to new kinds of problems. 'While the ban has managed to check the proliferation of carry bags and cutlery, due to the exemption given to aluminium foils, plastic pouches with silver coating are passed off as silver foils. These are especially popular amongst the hotels and takeaway businesses. These are not only more harmful to human health and the environment, but they also pose a major challenge for

recycling due to their size and the organic content such as *sambhar, chutney* and *raita* present in them. They have no use but to be junked to the dump yard', she added.

Affirming the need for stringent action against the violators for the successful implementation of the ban, Sanitary Officer and Nodal Officer of Swachh Bharat Mission, Mr. K.V. Thirumaal said that in Coimbatore district, daily searches and seizures are being conducted. *'Every day, we raid markets, commercial complexes and seize up to 500 kg of banned plastic materials. We have been imposing heavy fines on traders and consumers to the tune INR 50,000 to penalise offenders. This has certainly disincentivised the use of banned items within the district'*, he said.

Lessons from Tamil Nadu

The ban in Tamil Nadu presents a great opportunity to learn from the experience to amplify the successes and mitigate the failures, both within the state and for the rest of the world.

- One of the biggest issues with the ban in the state, as is globally, is the lack of stringent enforcement. If the laws are not enforced strictly, the compliance reduces as we understood from the experience of the respondents. Businesses and consumers must be constantly reminded of penalties to punish non-compliance and facilitate behavioural change.
- Currently, the ban has prompted the creation of an illegal 'black market' in the state due to the proliferation of banned products from the neighbouring states. There is an urgent need to raise a firewall against the infiltration of these products into the state. This may not be possible unless a national ban is enforced.
- While the government considered the alternatives for the banned plastics as seen from the campaign materials and notification, it did not identify the potential avenues from where the alternatives could be made available. A rehabilitation package for those who lost their jobs due to the ban could have been offered in the form of incentives for creating jobs in the alternatives sector. This could have addressed the twin problem of loss of jobs in the plastic sector and sustained and cheap prevalence of alternatives for the banned items.

- Plastic bans themselves do not address the larger problem of waste disposal. The two issues go hand in hand. While plastic ban can help climb up the waste hierarchy by 'reducing' the waste generated, it is not a substitute for effective waste management systems. Currently, the ban seeks to eliminate limited number of problematic single-use plastics only. If the government has to address environmental and public health impacts of plastics, it must consider the negative impacts of waste management systems in its entirety and work towards the effective implementation of Solid Waste Management Rules 2016 which mandates source segregation and decentralisation. This will further put the onus on consumers and municipal authorities to reduce the waste generated at source.
- While consumers and public officials expressed concerns about the growing tide of multi-layer plastics which form the bulk of packaging plastics, the discourse around EPR is yet to take-off in a robust manner. The state must play a more proactive role in bringing the companies to pay for the waste they produce. Being the second largest economy in India, the state has an excellent opportunity for pioneering Extended Producer Responsibility (EPR) to strike the plastic problem at its very root.

5. Textiles: The New Plastic

Textile waste is also an emerging challenge for the global waste management. It is estimated that on an average consumer spends 6% of its income on clothing and footwear globally[7]. Clothing is also one of the basic needs of human survival, thus, with the consumer base of 7 billion people in the world, textile and apparel industries are one of the largest industries in the world and contribute significantly to the global trade[8].

In recent years, there has been a growing conversation around our impact on the environment and the contribution of textiles to waste generation and environmental pollution. Due to a growth in textile consumption, textile industries around the world have felt the pressure to cater to a growing demand, which has led to a surge in *fast fashion*. Man-made fibres have been developed to meet this demand; however, they pose multiple threats to our environment since their production process tends to be heavily polluting, and even after their use, their disposal is a challenge since they are resistant to decomposition. This study addresses the ecological footprint of synthetic fibres and is focused on one aspect of these: waste from post-consumer clothing and textiles from synthetic fibres.

[7] *Fashion United: https://fashionunited.in/statistics/fashion-industry-statistics-india/*
[8] *Science Direct: Textile and apparel industry: https://www.sciencedirect.com/topics/engineering/textile-and-apparel-industry*

5.1 Textile Fibres: An Overview

There exists a diverse range of fibres in the textile industry today. These fibres can be categorised into two broad categories – natural fibres and man-made fibres:

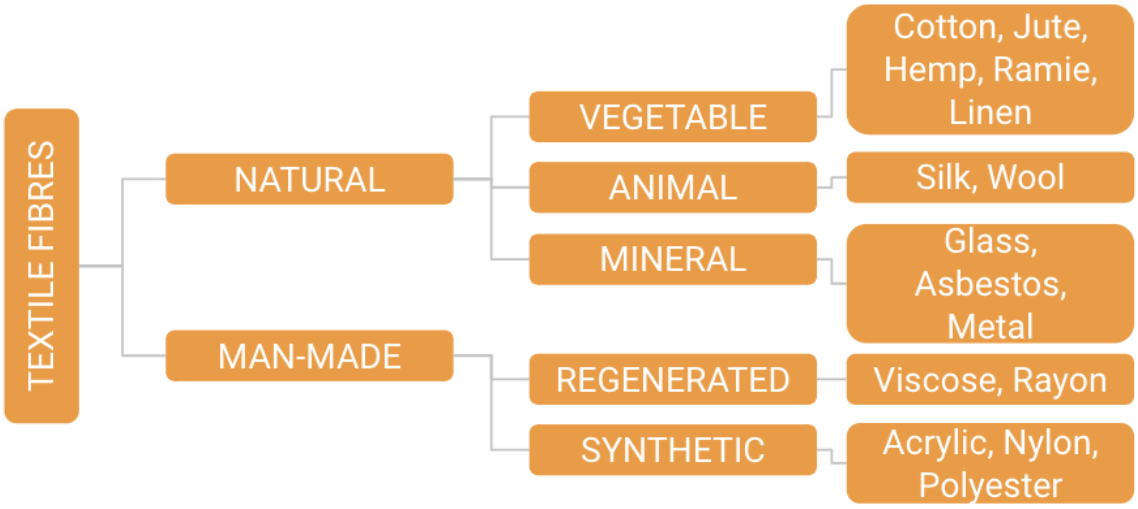
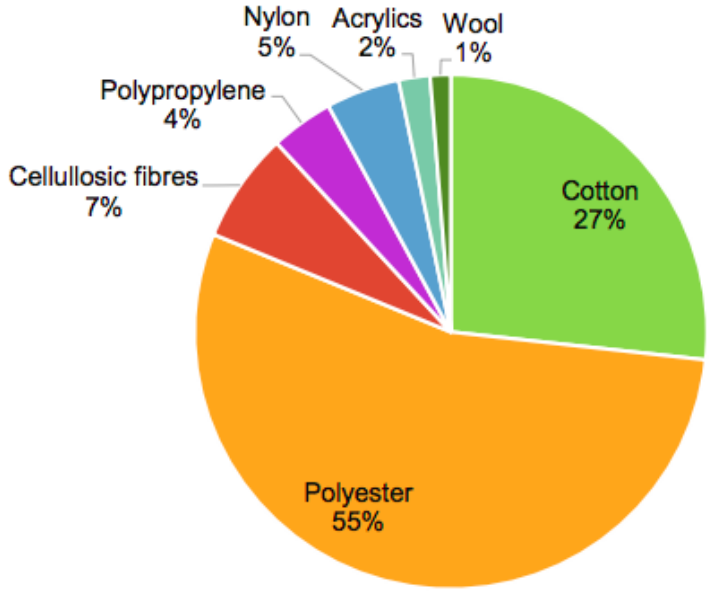


Figure 7: Categorisation of Textile Fibres

Synthetic Fibres

Man-made fibres produced for commercial purposes are commonly categorised as cellulosic and non-cellulosic fibres. Of cellulosic fibres, the most common are viscose, rayon, and acetate. Popular non-cellulosic fibres are polyester, nylon, and acrylic. These are all crude oil-based fibres and were developed in 1941, 1935, and 1941 respectively.

Synthetic fibres have gained immense popularity since then as they are more durable, stain and wrinkle resistant, cheaper, and easier to produce as compared to their natural fibre counterparts. The growing demand has in fact resulted in polyester constituting 55% of global fibre consumption, whereas cotton accounts for 25% according to waterfootprint.org (2016).



Source: Textile Exchange Preferred Fiber and Materials Market Report 2016

Figure 8: Global spinning mills' consumption of fibres in 2015

Production: Synthetic Fibres

To produce synthetic fibres, many chemical reactions and treatments are required. This includes:

Polymerisation – a chemical process that combines several monomers to form a polymer or polymeric compound.

Drying – after the material emerges from polymerisation, the long molten ribbons are allowed to cool until they become brittle. The material is cut into tiny chips and completely dried to prevent irregularities in consistency.

Melt spinning – the chips are melted at high heat and then pushed out of tiny holes, which makes the material emerge as long strands.

Winding – The strands are then drawn out and lengthened. After the yarn is drawn, it is wound up, ready to be woven into material.

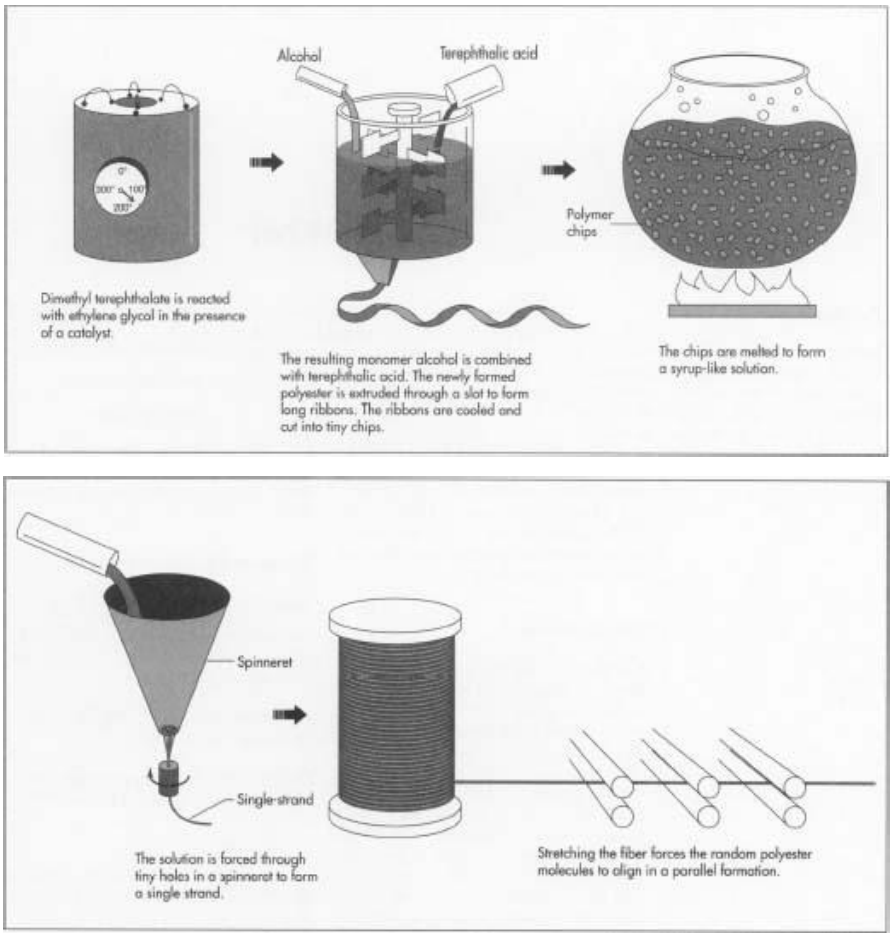


Figure 9: Production of Synthetic Fibres

Environmental Impact of Synthetic Fibres

Synthetic fibres are extremely polluting for two main reasons. Firstly, their production is extremely polluting and requires a lot of energy, and secondly, even after their production, they continue polluting the environment by shedding micro-fibres. In addition to this, they are not biodegradable and can persist in the environment for centuries.

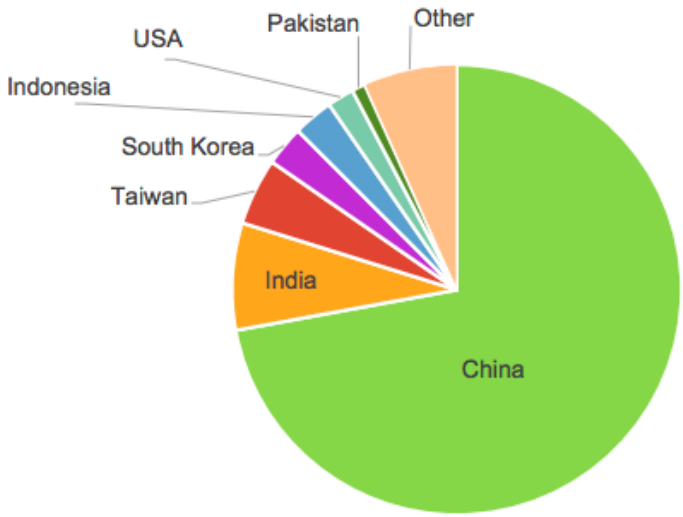
For clarity, we will look at different textiles and examine the harm they pose to the environment.

Pre-consumer harms

- **Polyester** is an energy-intensive fibre to manufacture. Its production is said to require more than double the energy required in the production of conventional cotton. Petroleum products are used as feedstock (raw material to make the fibre) and to generate the energy needed to manufacture.

Polyester is a synthetic petroleum-based fibre, and is therefore made from carbon-intensive non-renewable resources such as terephthalic acid, dimethyl terephthalate and ethylene glycol.
Energy consumption - Polyester production requires more than 12 times the energy required to produce the same amount of linen. Therefore, the production of 1 kilogram of polyester would require 123 megajoules as compared to linen that requires 10 megajoules.

Most polyester is produced in countries such as China, Indonesia, and Bangladesh where environmental regulations are lax, and air and water pollution is often discharged untreated, resulting in significant pollution and harm to communities in the vicinity of manufacturing plants.



Source: World Polyester Fibre – Trend in Demand and Supply 2015 (YarnsandFibres.com)

Figure 10: World's largest polyester fibre producers in 2015

The water intensity of production is much lower than that for natural fibres. By virtue of being a plastic, it is immune to the inevitable wear and tear that natural fibres are susceptible to, including staining. Polyester's immunity to staining means that it requires extremely strong synthetic (disperse) dyes which are known to be harmful. These dyes are derivatives of azo (a known carcinogenic), anthraquinone, nitro and other groups. Like polyester, they are also resistant to decomposition due to their complex molecular structure. This means that the detrimental impact on water supplies is potentially greater.

- **Rayon** is different from other synthetic fibres since it is not fully artificial as it is extracted from naturally occurring cellulose. It is not, however, a natural fabric, because cellulose requires extensive processing to become rayon. It is usually classified as a manufactured fibre and is considered a regenerated type of cellulose. The wood pulp that rayon is made from is manufactured by treating it with chemicals. It is then filtered and spun into a fine thread. This is a highly polluting process and releases many toxic chemicals into the air and waterways surrounding production plants.

Central to the process is carbon disulphide, a highly volatile and flammable liquid. The report cites evidence that carbon disulphide exposure is harming both factory workers and people living near rayon plants. The toxin has been linked to coronary heart disease, birth defects, skin conditions and cancer. Historically, its use was found to cause severe mental health issues in rubber factory workers exposed to high levels of the toxin. Other toxic chemicals used in the production of rayon include sodium hydroxide (caustic soda) and sulphuric acid.

- **Nylon** releases emissions of nitrous oxide (N_2O), which are 300 times more damaging than CO_{24} and which, because of their long life (120 years) reach the upper atmosphere and deplete the layer of stratospheric ozone, which is an important filter of UV radiation. In fact, during the 1990s, N_2O emissions from a single nylon plant in the UK were thought to have a global warming impact equivalent to more than 3% of the UK's entire CO_2 emissions.

In terms of its carbon footprint, Nylon is even more harmful than polyester in this regard, since it requires 25 times the energy required producing the same quantity of linen.

Therefore, synthetic fibres cause harm in different avenues, i.e. water-waste/chemical runoff, air pollution, carbon emissions, and toxic polluting gases. In addition to this, synthetic textiles pose environmental concerns even after their production.

Post-consumer waste

After production, synthetic textiles continue to pose concerns for the environment. The main reason behind this is that they are not biodegradable, and therefore, cannot be disposed off in a manner that benefits the environment.

Once synthetic fibres are produced, they are woven into textiles, which are then made into garments and other consumable products. After their purchase and during their use, they shed microfibres while being washed. By virtue of being extremely small, these microfibers get washed away with waste-water and end up in rivers, seas and oceans. These microplastics (since synthetics are plastic) are extremely prevalent due to the widespread use of synthetic fibres for most textiles.

Apart from shedding microplastics, synthetic fibres usually end up in landfills where they occupy space since they do not decompose. Often, they are incinerated since that is one way in which they can be disposed off; however, the process of incineration releases harmful chemicals into the air and generally adds to the growing carbon emissions present in the atmosphere, which go on to contribute to global warming.

Box 3

Chintan Survey at Bhalaswa Landfill in 2018

Chintan ran a survey from December 26th to 29th, 2018, in Delhi's Bhalaswa landfill, to understand the type and amount of textile waste in the landfill that was easy to retrieve. December is a relatively dry month and it is easy to retrieve waste compared to the monsoon or summer. Horticulture waste is also in reduced quantity, making textiles easier to see and access. We assumed that given that we were paying only Rs. 3 per kilo, or the same rate as low quality plastic bags, only easily available textiles, i.e. those discarded in the last few days at most, would be easy to pick and therefore sold to us. A wastepicker who runs a small waste shop was trained. Her task was to co-run the surveys and purchase the textiles. In all, approximately 100 kilos of clothes/textiles were found on the landfill per day. These included discarded polyester blend sweaters, casual cottons, clothes made of synthetic blends and children's clothes in wearable condition. Many garments had sequins and other plastic accessories, intact. This lends credence to the fact that synthetic textiles follow the pathway of low value plastics in their post-consumer phase, and infact, post a challenge for both waste management and reduction.

https://photos.app.goo.gl/DHPYrCtuTfg69YEGA

In some cases, synthetic fibres are recycled to produce new products. This however, happens on a very small scale since the existing technology to recycle fibres reduces their quality and breaks them into smaller fibres that are not as strong as they were initially. For this reason, virgin synthetics are added to the recycled materials, which is counter-productive since the aim is to reduce the presence and harms of synthetics while reusing the amount that currently exists.

Another way of dealing with waste generated from textile products is to up-cycle it into newer products. This is a growing effort and many initiatives have come up in this regard, but these still have to enter the mainstream textile industry.

Other practices that exist to deal with disposing textiles are donating or passing them down. There are many organisations where old fabrics and clothes can be donated; however, due to the large scale of production, donating it is not a strong enough counter force.

Natural Fibres

Before the advent of synthetic fibres, natural fibres of different kinds made up the base of all textiles and clothing. Even after synthetic fibres were created, natural fibres have been in use, but in smaller proportions. The most commonly used natural fibres are cotton, wool, silk, and linen that are plant and animal based fibres. All these fibres are derived and prepared differently, and due to this, their ecological footprints vary.

5.2 Textile Production in India

Synthetic textile production in India

- India is **2nd** to China in the production of polyester yarn and staple. It produces **8.63%** and **10%** of the global production of polyester yarn and staple, respectively.
- In terms of exports, India is the **2nd** largest exporter of polyester yarn (valued at 10974 crore INR or 1.55 billion USD) and the **5th** largest exporter of polyester staple (valued at1840.8 crore INR or 0.26 billion USD).
- India is approximately in the **top 10** producers globally for other synthetics like nylon and acrylic. Its main textile exports are cotton and polyester.

The main producers in India are concentrated around Gujarat and Maharashtra. The main textile producing companies in India are– Reliance, Bombay Dyeing, Arvind, Sanghi, Vardhman, Grasim (Aditya Birla Group), Raymond, and JCT Limited. Their turnovers vary from 1 billion USD to 70 million USD.

Given that we now know the extent of damage and harms emerging from the synthetics industry, we can infer that India produces a significant amount of textile chemical waste and microplastics.

5.3 Legislation, Regulations and Certification

It is recognised that textiles are a major source of pollution. There exists a range of implications for the environment due to the pollution generated by the textile industry. Due to this, several

initiatives have been taken. One such initiative is legislation and regulations to monitor the negative ramifications of textile production.

Internationally, there exists little legislation about textile waste specifically. However, due to the growing concern around synthetic fibres and the fashion industry, the impact textile waste has had on the environment has come into the spotlight and is becoming a part of the mainstream conversation of environmental pollution. Apart from this, there exist strict environmental laws regarding the emissions to air and water, waste management and hazardous inputs used during production. Internationally, there is also a growing precedence in protocols for the kinds of chemicals allowed within state borders. These must be strictly adhered to and if they are not, it results in penalties and other such consequences.

The European Union

In terms of particular legislation for banning hazardous chemicals, the European Union came out with a revised list of harmful chemicals that are restricted from being used in textiles. These hazardous substances are not allowed to be used in the production of clothing and other textile articles that come into contact with human skin and footwear. These groups of restricted substances include heavy metals, phthalates, polycyclic aromatic hydrocarbons (PAHs), formaldehyde, certain azo dyes, etc.

Extended Producer Responsibility is an incentive-based approach under which producers are given the responsibility of handling the disposal or treatment of their products at the end of the product's life with a consumer. The manner in which the incentive structure works is that it pushes the financial or even physical burden of dealing with the environmental cost of production onto the producers, forcing them to consider those costs at a pre-emptive stage. To tackle this, producers must find ways to create sustainable products, and recycle and lessen the amount of waste they generate through their products. EPR was initiated in European countries at first, but now many other countries have followed in the same path of incentivising producers to produce more sustainably. The arena in which this policy is most visible is electrical appliances and electronics; however, the same principle can be extended to textile production as well.

The United States

In the United States, three significant bills on microfibre pollution have been tabled/passed. In Connecticut, a bill was passed in May 2018, which organised a group of representatives from both the apparel and environment community to create an awareness program that provides consumer-oriented information about better initiatives for customers to reduce the shedding of microfibres, and information on the efforts of apparel industry members. In New York, a similar bill has been referred to the Committee on Environmental Conservation. The bill requires an additional care label by January 1, 2020 on clothing made of more than 50% synthetic material. The required care label would provide directions to prevent shedding such as handwashing, as well as state that the garment sheds plastic microfibres. California is the third state to table such a bill, and the bill would require that new clothing made from at least 50% synthetic material include a care label that informs consumers that the clothing sheds plastic microfibres when washed. It would also require a visible label at the point of sale that says, *'This garment sheds plastic microfibres when washed, which contributes to marine plastic pollution.'*

While it is not directly regarding textile waste, the Green New Deal in America envisions a new economy that eliminates the presence of carbon in the economy, and depends entirely on cleaner energy sources. It hopes to revamp the existing way of production and create a sustainable way of life for America. This conversation is a relevant one internationally since it sets a precedent for other countries to follow with large-scale structural changes in their own economies.

Despite the absence of laws on textiles, there exist a number of organisations that provide certification for a brand's ability to produce sustainably. These organisations partner with brands to help them achieve sustainability goals, or provide them with markers to look out for when they are sourcing sustainable materials to manufacture.

India

The Indian government has built multiple production compliances, which range from labour, social, environmental, and compliances for waste disposal and other manufacturing requirements. The objective of these rules and regulations is to provide a framework for the industry to work such that

it does not cause harm to society or the environment. However, none exist in the specific area of textile related waste.

5.4 Reduction of waste: corporate action

Private corporations play a leading role when it comes to moving towards more sustainable textile production. Since consumers interact with retailers far more than they do with the manufacturing process, it becomes imperative that retailers and corporations begin implementing changes from their end. Many companies have sustainable claims and initiatives that give us an understanding of the challenges and opportunities they face while transitioning.

Zero Discharge of Hazardous Chemicals (ZDHC) is a coalition of fashion brands, value chain affiliates and associates. Their aim is to eliminate hazardous chemicals from the production process of the global textile, apparel, and footwear industry. They operate in a manner such that all phases of the production process can be evaluated for the involvement of harmful chemicals. Therefore, their services and tools are divided along the line of the Input Focus Area, the Process Focus Area, and the Output Focus Area. Some large fashion retailers that are committed to the cause are Adidas, Burberry, H&M, Intidex (Zara's parent company), Nike, C&A, ASOS, etc.

The CEO Water Mandate aims to address global water challenges by mobilising business leaders in partnership with the United Nations, governments, civil society organizations and other stakeholders. The companies that endorse the mandate implement water stewardship by identifying and reducing critical water risks to their businesses, seizing water-related opportunities, and contributing to water security and Sustainable Development Goals. These span over six key areas, which the endorsing companies must report their progress on annually. These areas are direct operations, supply chain and watershed management, collective action, public policy, community engagement and transparency. Some of the endorsing companies are Calvin Klein, Gap Inc., Intidex (parent company of Zara), Nike, H&M, etc.

The Global Recycle Standard is a voluntary full product standard that lays down stipulations for third-party certification of recycled materials, chain of custody, social and environmental practices

and chemical restrictions. It helps companies that wish to certify the recycled material from their products as well as certify sustainable social, environmental and chemical practices.

Better Cotton Initiative (BCI) is an international cotton sustainability programme that aims to train farmers on more sustainable cotton farming practices. BCI prioritises minimising the negative impact of crop protection practices, water management, and the health of the soil, the surrounding biodiversity, and the fibre quality. Beyond this, it focuses on ensuring fair labour practices and management. The 2017-18 report of the BCI states that over 5 million metric tonnes of Better Cotton were produced, accounting for 19% of global cotton production. Companies that have partnered with BCI are Adidas, Aditya Birla Fashion and Retail Ltd., ASOS, Gap Inc., H&M, Intidex (parent company of Zara), Ikea, etc.

Global Organic Textile Standard (GOTS) is a certification that aims to define requirements that can be recognised globally and evaluate organic textiles from the stage of harvesting their raw materials to the point of labelling. This certification is only given to textile products that have at least 70% organic fibres, and all the chemical inputs must meet environmental criteria. To acquire a GOTS certification, producers must have a wastewater treatment plant for any wet processing the product undergoes. Apart from this, it requires compliance with social criteria as well.

Box 4

Pre-loved clothing: A trend to strengthen

In earlier times, expensive clothes were often shared by family members as an everyday practice. Sometimes, particularly unique and expensive items were passed on as heirlooms. This has changed today, where each member of a nuclear family actually owns clothes to be worn only by them. Yet, there is a nascent movement of re-used clothing. Paris, one of the centres of fashion, has a slew of second-hand clothes shops. Each one is specialised. Some sell only high-end designer clothes and bags, while others sell regular clothing. Each has high acceptance and is located in areas of the city where the client base is most likely to be the greatest. On Facebook, a group of saree lovers has been exchanging sarees under the group ‘Pre-Loved Sarees’. Other such initiatives exist, indicating the nascent movement towards sharing clothes outside of one’s family and close friends. These should be encouraged through space allocation in appropriate government-owned buildings and shopping areas, advertising to attract others and a small fund to start these. The funds are used to pay initial rentals, or take professional photos or a social media advertisement or even, make an app, etc.

Large international retailers tend to have initiatives towards sustainability, especially now, given that the conversation about the environment has grown. This is often done by publishing information about how and where they source their materials and commit to continuous transparency in this sphere. Sourcing materials is majorly responsible for defining the kind of pollution generated in the textile industry; for instance, polyester has more negative implications on the environment as compared to organic cotton. Due to this, companies like Intidex and Adidas have committed to sourcing responsibly and they do this by looking out for certifications like the ones mentioned earlier. This ensures that right from the textile-making process, negative externalities are accounted for and preemptively dealt with.

Along the same lines, retailers also publish sustainability reports that cover the broad areas of textile waste and impacts such as carbon emission and air pollution, water pollution, biodiversity, energy consumption and labour practices. These reports provide data on how the companies are performing in these categories, and the kinds of initiatives they're taking to counter the waste and pollution they produce. This is often done due to the direct incentive of projecting a better image for the company, and it also allows consumers to gauge the sustainability of a brand. Moreover, this also opens doors for brands to tackle environmental challenges in innovative ways.

Recycling schemes have been popularised by brands that have launched 'close the loop' initiatives. These initiatives seek to create a circular apparel industry where garments can be bought, worn until the consumers need to dispose them, at which point they can donate their old garments to retailers who recycle these into new usable fibres that will go on to produce new garments. H&M was one of the first retailers to launch this narrative, promising to give old clothes a 'new life'. For this, they have started a recycling scheme under which those who donate their old clothes get discounts on future purchases. Apart from this, many brands have 'conscious' lines of fashion; according to the retailers, these lines are made out of responsibly sourcedfibres, and have a low ecological footprint.

While these companies claim to source sustainable fibres, they destroy the sustainability of the garment by mixing synthetic fibres into them for multiple reasons. One reason is that it incorporates properties of synthetic textiles (stain and wrinkle resistant) into the resultant blended fabric.

Another reason is that synthetics are less water intensive than natural fibres, thus to reduce their water consumption, synthetics are mixed with natural fibres, rendering them all synthetic. This poses challenges later in the lifetime of the garment when it comes to recycling because it is difficult to separate the blended fibres, and separating them damages the strength and integrity of fibres.

While these companies publish their sustainability reports, they fail to state their carbon and water emission targets. This makes their other sustainability claims seem aimless and unfounded. It also makes it difficult to hold the corporates accountable for not reducing the impact in these spheres, since they never declared an exact target.

When it comes to recycling, the technology doesn't exist at the scale for the retailers. The breaking down of the fibres makes them lose their strength and quality, and to produce fabrics from those fibres requires the incorporation of virgin fibres. This, therefore, continues status quo of production of more materials rather than the reuse of existing ones. Due to this, the recycling schemes that are seen at large retail stores tend to 'downcycle' the donated fabrics, turning them into industrial insulation and low quality textiles, such as shoddy blankets.

Apart from this, the fundamental concern when it comes to creating a sustainable textile industry is the mode of operation for most retailers today. This mode is a fast fashion model of business. In this, the latest styles and trends seen on catwalks and celebrities are reproduced very quickly and sold at low prices. Through advertising and regular sales, consumers buy large quantities of clothing, much more than they did in the past. Since the clothes are quickly and cheaply produced, they aren't made to last, and therefore, fall apart after just a few years. Fast fashion is the driving force behind the environmental repercussions of the textile industry since synthetic textiles have been used to feed the demand generated by fast fashion. The damages accrued by the use of synthetic fibres have been analysed earlier, and therefore, those same issues are posed at the scale at which fast fashion operates.

While most large mainstream retailers haven't been able to entirely overcome their own ecological footprint, other brands that deal in textiles have made headway in reducing their dependence on the environment, thus becoming sustainable brands.

Adidas is considered a significant voice in the conversation surrounding the responsibility of corporates in reducing pollution and damage to the environment. A founding member of the Better Cotton Initiative, they have committed to sourcing sustainably from certified producers. They partnered with an ocean conservation group, Parley for the Oceans to produce products that are made out of recycled ocean-waste. They regularly maintain transparency in the supply chain of their products, and also go to the extent of publishing the targets they have set for themselves to reduce the carbon and water emissions in a local context-based manner. Apart from this, they have also created guidelines to help entities like themselves to achieve sustainable performance levels. These are kept public to allow other companies to make a transition to more conscious production.

Patagonia is an American outdoor apparel brand where production is centered around finding solutions to the environmental crisis. It uses organic cotton certified by Global Organic Textile Standard and Bluesign Standard for more than half of their fabrics. Their materials are made of recycled fabrics, like polyester and nylon. Their business model rejects fast fashion as they aim to make long lasting, high quality products which even at the end of their lifetime can be put through a repair and reuse programme offered by Patagonia. They have gone to the extent of discouraging customers from buying too many of their products, so as to reduce consumption levels.

Box 5

Pure Waste

Pure Waste is a clothing company that is looking to recycle waste textiles into usable garments. Their recycling unit is located in Tiruppur, Tamil Nadu in India, where they have generated almost 200 jobs. Their business is centred around treating the environment and the people who live in it as well. They do this by complying with international and local labour regulations. Their factory is designed to provide a safe and productive workplace for their employees. In terms of their contributions to protect the environment from further damage, they power their factory through renewable energy sources, namely wind and solar power. They have reused plastic bottles of the area to create a fence surrounding the factory. Their product itself uses old discarded fabrics. These fabrics are opened, carded, and sorted according to fibre and colour, then spun again, after which they can be woven into new textiles. Since the fabrics are already dyed, they don't require energy and chemicals to dye them again. This prevents the release of toxic run-off into the neighbouring areas.

Similarly, several factories in Panipat, Haryana, are using imported woolen textiles and creating blankets from these.

The Indian landscape has also seen the emergence of sustainable apparel brands that pledge themselves to conscious production and minimal waste. While they face many challenges in becoming fully sustainable, they have made headway in empowering local textile-producing communities while also reducing their water and air emissions. There are also initiatives that seek to create a network that helps unwanted clothes find a new home without resulting in more purchases - an exchange system of sorts. Companies of this nature are Upasana, Adah by Leesha and ThisForThat.

Innovations in Fibres

Innovations in fibres range from more well-known ones like Tencel, to lesser known ones like QMilk. These fibres pose less of a burden on energy and water resources, and they are biodegradable; therefore, they do not persist in the environment indefinitely. **Tencel,** for instance, is made out of dissolved wood pulp that is pushed out of spinnerets to form threads that can be spun into yarn after chemical treatment. Though the solvent used to turn the wood into pulp is petroleum-based, the company that produces Tencel follows a closed loop process, and therefore, the solvent is recycled to produce new Tencel fibres. This minimises harmful waste. In addition to this, Tencel requires lesser dye than even cotton, therefore reducing the amount of harmful chemicals used in the dyeing process.

QMilk is a milk based fibre that is fully biodegradable, low on water and energy consumption, and has a short production process. It produces less waste, and in fact, uses discarded milk as the raw material to produce milk-based fibres. The protein is extracted from the milk and water is added to it to make a dough-like formation that can be extruded from small exit holes. The narrow threads that come out are spun into yarn which can be woven into fabric which has all the qualities mentioned earlier.

For plant based fabrics, there exists a range of materials that acts as an input for the production of textiles. These inputs are bananas, hemp, and even flower petals. Fibres are produced by either extracting them directly from the plant or from the cellulose. These are biodegradable and do not use chemicals at the scale of synthetic fibres. By adopting water and energy conscious methods, these materials can be made fully sustainable.

Technology exists to reduce waste from the conventional textile manufacturing process. As mentioned earlier, one of the major points at which hazardous chemicals are used is when the fibre is dyed. Many conventional dyes are carcinogenic, non-biodegradable, and also pollute the soil and water, which they come in contact with. Less polluting alternatives are natural dyes, as well as waterless dyeing. Both produce minimal waste and can cut down the harmful chemicals used. Aranya Natural eliminates a range of harmful chemical dyes and processes from the production chain of fabrics. This company makes natural dyes from plants, foods and even insects.

Companies such as AirDye have created technologies that allow manufacturers to dye their fabrics without using copious quantities of water. This technology uses pressure and heat to transfer pigment from paper onto the fabric by attaching a molecule of the dye to a molecule of the fibre. Other organisations that are innovating waterless dyeing methods are DyeCoo and Colorzen. However, the issue with these innovations is that they're extremely expensive - a single dyeing unit can cost anywhere between 2.5 to 4 million USD. Along with this, some limitations exist regarding which fabrics can be dyed using these technologies.

Challenges to Sustainability

Recycling

Recycling textiles and garments is a commitment many retailers are attempting to uphold. However, as mentioned earlier, the existing recycling technology hasn't developed enough to recycle fabrics without damaging them. This, therefore, becomes a factor that deters corporations from being able to recycle fabrics rather than 'downcycling' them to industrial insulation or wiping materials. Since many of the textiles consumed today are a blend of natural and synthetic fibres, separating the two becomes extremely difficult, and even if they are separated, the process shortens the fibres, which rids them of their sturdiness. Even if a retailer manages to recycle old textiles, some amount of virgin fibres has to be introduced to provide the recycled fibres some strength. This essentially results in more production than consumption of the existing textiles.

Fast Fashion

Other challenges are linked to the mode of production most retailers follow in the current apparel industry is one of fast fashion. Since the leading fashion companies release new clothing collections every few weeks, consumers are driven to buy more garments in a shorter period of time, which only increases the amount of garments produced. These garments end up following conventional processes of disposal that increase global carbon emissions and non-biodegradable waste. With the prevalence of social media, consumers can follow trends internationally as well. This, coupled with the aim of maximum profit generation, results in the mass production of inexpensive clothes, while the employees who create them are paid less than minimum wages. Many major retailers do not follow the regulations set by organisations such as the International Labour Organisation. This allows them to profit while their employees remain under-paid. Apart from the condition of their employees, retailers are unwilling to invest in technology that enables sustainability. This is because such investments would bring down their profits and the existing technology is expensive. It requires retailers to manage their water usage and waste, carbon emissions, as well as their energy consumption.

Problem of microfibres

Garments made of synthetic material or synthetic blended with other material cause leakage of microplastic (in the form of microfibres) during each wash that gets into the sewage system, rivers, and ultimately pollute oceans and is extremely difficult to filter them out. Microfibre pollution is one of the biggest sources of microplastic pollution in the oceans

Box 6

The Burberry Incinerator case

Instances of wastefulness and lack of concern for the environment have sparked outrage amongst consumers. One such incident was that of the brand Burberry incinerating their unsold stock in 2018 to prevent it from selling for a lower price. To maintain their brand value, Burberry, rather than slowing down their production, chose to incinerate their inventory.

This resulted in international outrage and boycott of Burberry, which then had to release a statement declaring they will no longer destroy or damage their unsold products. Rather than going through the process of being held accountable for bad environmental practices, brands can capitalize on the goodwill and positive feedback that sustainable brands garner. Therefore, their incentive to transition to sustainable production lies partially in the impact it would have on their brand image. While some brands will follow this incentive, those that do not will experience growing scrutiny. The movement towards sustainability could make them stand out as outliers, which will have an unfavourable influence on their brand image.

6. Our Wasted Food: The Way Out

6. 1 Introduction

In 2011, Food and Agriculture Organization (FAO) estimated that 1/3rd of global food produced is wasted annually[9]. United Nations estimate that nearly half of all fruits and vegetables produced are also wasted each year. China wastes almost 50 million tonnes of grains which is enough to feed 1/6th of its population[10]. Ministry of Food Processing in India estimates that the agricultural produce worth 580 billion Rupees is wasted in India each year[11]. Overall, it is estimated that food losses and waste are worth US$ 680 billion in developed countries and US$ 310 billion in developing countries.

Thus, plastic, textile and food waste add immense burden to the global waste but also hold opportunity to be made part of circular economy for overall waste reduction

According to The Asian Age (Qazi, 2017), twenty-one million metric tonnes of wheat — almost equal to Australia's production — rots each year in India due to improper storage. According to the Associated Chambers of Commerce, the country experiences a post-harvest loss of INR 2 lakh crore annually due to lack of food processing units and storage facilities. The World Bank recently warned that 60 per cent of the country's food subsidies do not reach the poor; they are sponged by middlemen.

The Food Corporation of India (FCI) was set up in 1964 to offer impetus to price support systems, encourage nationwide distribution and maintain sufficient buffer of staples like wheat and rice but has been woefully inadequate to meet the needs of the country. Around 1% of GDP gets shaved off annually in the form of food waste. According to the Ministry of Agriculture and Farmers' Welfare, INR 50,000 crore worth of food produced is wasted every year in the country; 1 million tonnes of onions vanish on their way from farms to markets, as do 2.2 million tonnes of tomatoes. Tomatoes

[9] FAO, Food Loss and Food Waste, 2019: http://www.fao.org/food-loss-and-food-waste/en/
[10] UN Environment, Worldwide Food Waste: https://www.unenvironment.org/thinkeatsave/get-informed/worldwide-food-waste
[11] Rediff News, 2007 cited in Lundqvist et al., 2008

get squished if they are packed into jute sacks. Overall, 5 million eggs crack or go bad due to lack of cold storage.

Food waste also means many other previous natural resources wasted. In resource terms, India is estimated to use more than 230 cubic kilometres of fresh water annually — enough to provide drinking water to 100 million people a year — for producing food items that are ultimately wasted. Besides this, nearly 300 million barrels of oil used in the process is also ultimately wasted. Wasting a kilogram of wheat and rice would mean wasting 1,500 and 3,500 litres of water respectively that is consumed in their production. Strong research evidence identifies it not only in terms of wastage of valuable resources, but also due to its environmental impact. There is considerable emerging evidence to suggest that landfilled food may be one of the major causes of landfill methane emissions (Food and Agriculture Organisation, undated). Climate change and its impact on food availability and access to a potentially 'at risk' population, has also drawn attention. Thanks to a significant global conversation and data, food waste has started receiving much more attention at the policy and management level.

However, there are conceptual difficulties in defining food waste, leading to estimation discrepancies of quantum, sources and possible remedies. While this chapter will focus on post consumer food waste, it will reflect on the entire chain at a landscape level.

6.2 Defining Food Loss and Waste

Food loss is defined as 'the decrease in quantity or quality of food'. Food waste is part of food loss and refers to discarding or alternative (non-food) use of food that is safe and nutritious for human consumption along the entire food supply chain, from primary production to end household consumer level. Food waste is recognised as a distinct part of food loss because the drivers that generate it and the solutions to it are different from those of food losses. (FAO, 2014)

According to FUSIONS[12], 'Food waste is any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)'.

Drink and liquid waste, fish discarded to sea and waste of any materials that are ready for harvest, but which are not harvested, are included in FUSIONS's definition of food waste, making its perimeter wider and broader than many other existing definitions. FUSIONS also considers inedible parts of food (e.g. skin and bones) as food waste in order to support the development of resource efficient and sustainable food systems in the EU.

Conceptually, FAO's definition also covers:

- Food loss refers to a decrease in mass (dry matter) or nutritional value (quality) of food that was originally intended for human consumption. These losses are mainly caused by inefficiencies in the food supply chains, such as poor infrastructure and logistics, lack of technology, insufficient skills, knowledge and management capacity of supply chain actors, and lack of access to markets. In addition, natural disasters play a role.
- Food waste refers to food appropriate for human consumption being discarded, whether or not after it is kept beyond its expiry date or left to spoil. Often this is because food has spoiled, but it can also be for other reasons, such as oversupply due to markets, or individual consumer shopping/eating habits.
- Food wastage refers to any food lost by deterioration or waste. Thus, the term 'wastage' encompasses both food loss and food waste. (FAO, 2013)

[12]FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies) is a project about working towards a more resource efficient Europe by significantly reducing food waste. The project ran for 4 years, from August 2012 to July 2016, funded by the European Commission Framework Programme 7.

For this study, the above definition will be used to refer to Food Loss and Waste (FLW).

Food Supply Chain

The food supply chain connects three main sectors: the agricultural sector, the food processing industry and the distribution sectors (wholesale and retail). Basic agricultural commodities undergo, to varying degrees, an often substantial series of intermediate alterations before they are sold as final food products to consumers. The first sector considered in the food supply chain is the agricultural sector. Its activities include crop production and the raising of livestock. As agricultural commodities comprise of very different products, the sector's distribution channels are equally diverse. Firms in the agricultural sector primarily sell their output to the food processing industry and to itself (e.g. animal feed), but also sell directly to retailers, final consumers or alternative markets (e.g. biofuels).

The food processing industry is very heterogeneous and comprises a number of varied activities. These include, for example, refining (sugar), milling (cereals), cleaning, cutting or drying (fruit and vegetables) and slaughtering and disassembling (livestock). The different inputs are processed in successive stages and to different degrees, packaged and dispatched to customers (e.g. distributors, food service). Another important activity of food manufacturers is to carry out market and product research leading to the development of new products, and to engage in marketing. The distribution sector (and retail in particular) is the principal outlet for food products, and being the final link in the supply chain, it interacts directly with final consumers.

Roughly one-third of the edible parts of food produced for human consumption gets lost or wasted globally, which is about 1.3 billion tonnes per year. Food is wasted throughout the FSC, from initial agricultural production down to final household consumption. In medium and high-income countries food is to a great extent wasted, meaning that it is thrown away even if it is still suitable for human consumption. Significant food loss and waste do, however, also occur early in the food supply chain. In low-income countries food is mainly lost during the early and middle stages of the food supply chain; much less food is wasted at the consumer level.

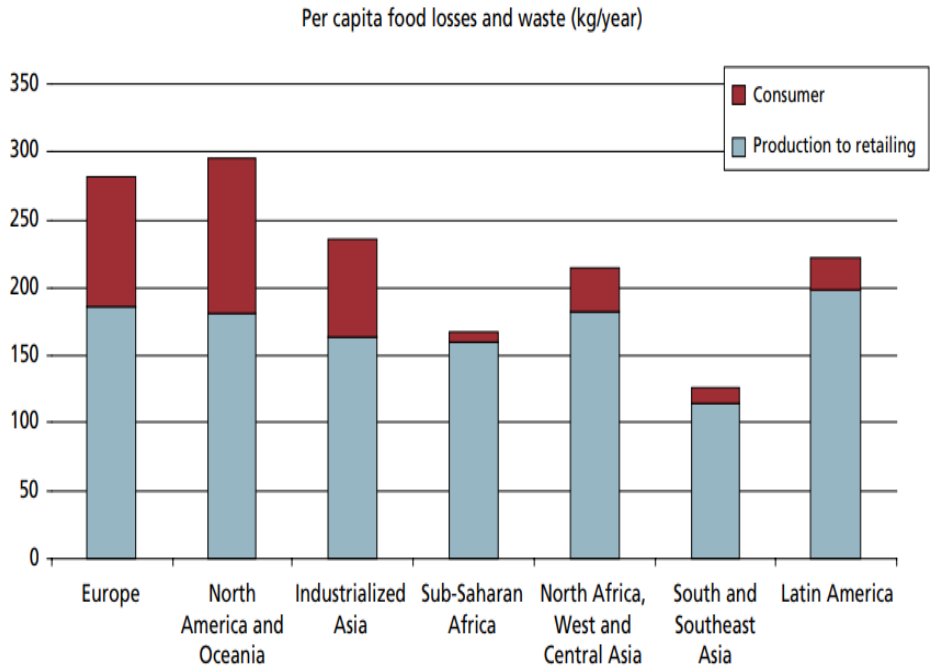


Figure 11: Per Capita Food Losses at Various Stages in Different Regions[13]

[13]Available on http://www.fao.org/3/mb060e/mb060e02.pdf

Production	Handling and Storage	Processing and Packaging	Distribution and Market	Consumption
DEFINITION				
During or immediately after harvesting on the farm	After produce leaves the farm for handling, storage, and transport	During industrial or domestic processing and/ or packaging	During distribution to markets, including losses at wholesale and retail markets	Losses in the home or business of the consumer, including restaurants/caterers
INCLUDES				
Fruits bruised during picking or threshing	Edible food eaten by pests	Milk spilled during pas-teurization and processing (e.g., cheese)	Edible produce sorted out due to quality	Edible products sorted out due to quality
Crops sorted out post-harvest for not meeting quality standards	Edible produce degraded by fungus or disease	Edible fruit or grains sorted out as not suitable for processing	Edible products expired before being purchased	Food purchased but not eaten
Crops left behind in fields due to poor mechanical harvesting or sharp drops in prices	Livestock death during transport to slaughter or not accepted for slaughter	Livestock trimming during slaughtering and industrial processing	Edible products spilled or damaged in market	Food cooked but not eaten
Fish discarded during fishing operations	Fish that are spilled or degraded after landing	Fish spilled or damaged during canning/smoking		

Figure12: Food loss and wastage along value chain

Value of Food Waste

- Roughly one third of the food produced in the world for human consumption every year — approximately 1.3 billion tonnes — gets lost or wasted.
- Food losses and waste amount to roughly 48,14,400 crore INR (or 680 USD) billion in industrialised countries and INR 21,94,800 crore INR (or USD) billion in developing countries.
- Industrialised and developing countries dissipate roughly the same quantities of food — respectively 670 and 630 million tonnes.
- Fruits and vegetables, plus roots and tubers have the highest wastage rates.
- Global quantitative food losses and waste per year are roughly 30% for cereals, 40-50% for root crops, fruits and vegetables, 20% for oil seeds, meat and dairy plus 35% for fish.
- Every year, consumers in rich countries waste almost as much food (22.2 crore tonne or 0.222 billion tonnes) as the entire net food production of sub-Saharan Africa
- The amount of food lost or wasted every year is equivalent to more than half of the world's annual cereals crop 230 crore tonnes or 2.3 billion tonnes in 2009/2010).

- Per capita waste by consumers is between 95-115 kg a year in Europe and North America, while consumers in sub-Saharan Africa, south and south-eastern Asia, each throw away only 6-11 kg a year. (Excerpted from the FAO website)

In the absence of any comprehensive valuation techniques, FLW estimates use retail prices of food to estimate value. According to a 2018 Reuters report[14] outlining the FLW problem in India, 194 million Indians go to bed hungry daily with India's rank in the Global Hunger Index at 103 among 119 countries in 2018. It is estimated that food needed to feed India's population is 22.5 - 23 crore tonnes or 225-230 million tonnes per year per year. Going by the farm output in 2015-16 of 270 million tones, more than sufficient food is available for the population. However, explaining the poor Hunger Index ranking, the report highlights the estimated FLW at 40% for India, amounting to 107 million tonnes annually, in volume terms or Rs. 88,800 crore per year or Rs. 244 crore per day in lost value, with crops left to rot in the sun without storage or transportation, or eaten by insects and rats. This wastage has a knock-on effect on the environment as well, as the efforts made to produce this generates greenhouse gases, use water, and can lead to deforestation.

The calculation of the value of FLW presents some interesting challenges. Valuation of FLW must be seen from three perspectives. From the accounting point of view, cost of the FLW is equal to the value of the food at each stage of the FSC, from which it originates. Here, this valuation runs into difficulties as valuation at each stage reflects the transaction costs incurred up to that stage, inflating the valuation. Secondly, value of FLW must also include the social and environmental cost of the FLW, which may be thought of as economic costs (Bellemare, et al 2017). In the former case, the wasting of food is associated with internal and external norms of conduct, which might impose social (in the form of social sanctions) or hedonic (in the form of feelings of guilt) costs on those who waste food (Evans, Campbell, and Murcott 2012). In the latter case, the food that goes to landfills emits methane and CO_2 as it decomposes (Hall et al. 2009), both of which contribute to climate change. Additionally, the environmental costs of food waste include the environmental impacts of depleting resources (e.g., water and land) in order to produce food that is eventually

[14] https://in.reuters.com/article/india-food-hunger/as-millions-go-hungry-india-eyes-ways-to-stop-wasting-14-billion-of-food-a-year-idINKBN1EU0UM

wasted. Possibly, valuation of FLW must also include landfill related costs of FLW. That is, costs related to opportunity cost of space devoted to FLW at the landfill, cost of transportation to the landfill along with the non-market cost of lost ecosystems.

As this is the best available, the results should be accepted and worked upon for change on the ground.

Drivers of Food Waste

Thyberg (2016) identified modernisation of food production and consumption systems, cultural factors, socio-demographic elements and policies/regulations as key drivers of food waste.

Modernisation

Industrialisation of food systems, which results in a transition of food production and preparation from the home to factory and from handcraft to purchasing, affects the foods that people consume, the types and quantities of food waste, and contributes to increased physical distancing of people from food production and preparation. In areas with industrialised food systems with large amounts of food processing, people often purchase pre-prepared foods, or canned and frozen vegetables. As a result, pea pods and corns husks, for example, become industrial wastes, while packaging becomes more common in household waste. In industrialised food systems, consumers often purchase pre-cut meats, such as chicken legs, so there are no other components of the chicken to be disposed as waste at the consumer level; the other parts of the chicken are utilised or disposed by industry during the chicken processing.

Increased frequency of eating at restaurants and consumption of takeout food (commercially prepared but consumed at home), may contribute to increased food wastage as adults tend to be less likely to waste food that they prepare themselves or that a loved one prepares. In cultures based on handwork, handmade things are valuable as they embody many hours of labour. People who have not created or prepared something themselves, or watched a loved one do so, value labour less than those who have, and therefore, are more likely to throw it away.

Higher incomes are generally associated with the consumption of a more varied diet. There is a world-wide trend of increase in consumption of western diets comprising protein and energy rich foods and convenience foods and relative decrease in consumption of indigenous starchy food staples. Western diets with vulnerable short shelf life foods are associated with greater food wastage and greater drain on environmental resources. Increasing diversity in diets may also lead to increased wastage as opportunities to incorporate leftovers in the next or new meal are reduced. With consistent traditional meals, there are endless possibilities of such incorporation, minimising leftover wastage.

Secondly, as incomes rise, people may be able to waste more food because food expenditure is no longer a major contributor to their total budgets.

Urbanisation requires extension of food supply systems, leading to diet diversification and disconnection from food production sources. People living in urban clusters have no sense of what their food is made of or how it was produced. Since food sources are removed from consumption, there are more opportunities to market diverse foods, not grown locally. Several studies have found that residual waste from urban households has significantly more food component than that from rural households.

Food production and consumption patterns have shifted from local to regional to global, in terms of quantity, type, cost, variety and desirability. Food tends to travel more over longer distances than earlier and consumers tend to consume more of non-local food.

Cultural factors

Culture plays a fundamental role in shaping food behaviours, nutrition and consequent waste generation. Countries like the US and Australia have few food traditions of their own and connection with long-standing food traditions and rituals is weak and mostly derived from other cultures. On the other hand, countries like France and India have strong appreciation of food, including preparation and consumption. Traditional recipes and strong values around food survive over generations. Culture also influences shopping behaviour like amount of food purchased in a

single trip, number of days between shopping trips and the amount of food stored in the household. The amount of food stored has been shown to be directly proportional to wastage (Karin etal, 2018).

Socio-demographic factors

Demographic factors like age, family composition and household size, family income tend to have strong relationships with consciousness about food waste. For example, older people tend to be more aware about food waste than younger children, possibly due to exposure to periods of food austerity during calamities, wars, rationing and other emergencies.

Policies

World over, policy framework standardises, regulates and mandates food usage, redistribution and disposal under certain conditions. These policies aim to achieve some overall benefit – food safety or enhanced nutrition. Furthermore, litigation considerations may discourage reuse or redistribution of edible food. There is a dichotomy at the policy level between the need for food safety and nutrition on one hand over the desire to reduce food waste on the other.

6.3 Food Loss and Wastage (FLW) Management Approaches

Current thinking on food loss and waste management approaches focus on the themes of reduction, re-use, redistribution, remediation and recovery. These are implemented as a combination of the following strategies:

- Improvements in harvesting, storage and transport of food from farm to fork
- Rationalising supply chain intermediaries to reduce layers
- Modernising and expanding food processing industry
- Diverting ‘unfit for human consumption’ food as animal feed
- Resource recovery from dumped food in the form of energy and nutrients
- Consumer awareness and behavioural change

- Rescue and redistribution of food through social and voluntary organisations
- Policy and legislative control

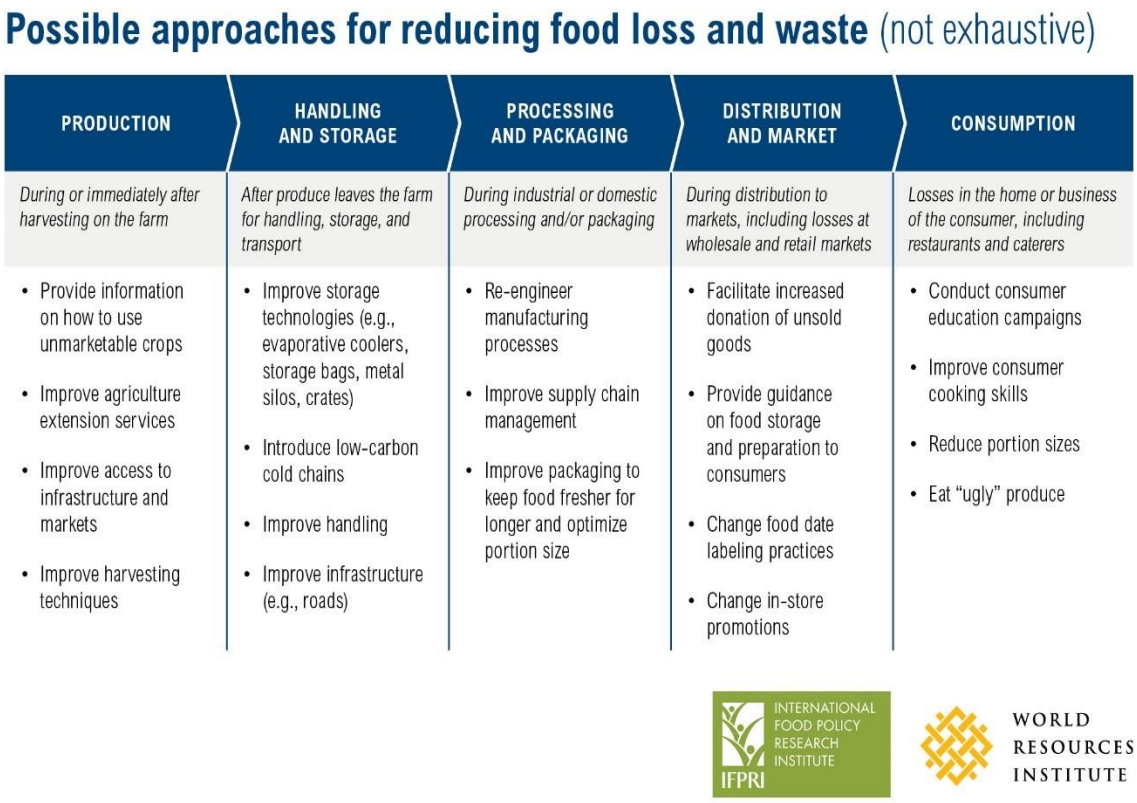


Figure 13: Possible approaches for reducing food loss and waste

While the top five of the above strategies are well researched and documented as solutions to minimising food loss, lately there has been considerable interest globally as well as regionally and at individual levels in the last three approaches, particularly in preventing food waste at consumption level. Consumer awareness and activism is being viewed as a particularly important aspect of the fight to reduce food waste. Aschemann-Witzel (2015) studied consumer behaviour in terms of food provisioning, date labelling, food service and delivery, household storage behavior, food packaging and waste disposal mechanisms. They found that consumers chose appearance as a cue for quality. They also noted a tendency to over-purchase in reaction to pricing (volume discounts and price grading). A considerable confusion was documented in the interpretation of date labels on food packaging. The perceived risk level is increased in scale by a lack of knowledge about real and assumed food safety risks. As a further trade-off especially

underlined by the experts, consumers or their household members might simply dislike eating the same meal or any leftover food, or they may even feel a certain disgust at the thought of storing or eating leftovers.

For consumer activism the authors noted the need to repeatedly provide information, since consumers tend to forget, and to deliver the information via various sources, as consumers differ as to which information source they rely on most. Information should also be in particular directed at consumers undergoing crucial life moments that are known to entail changes in perceptions and habits. Understanding date labelling seemed an especially important issue, potentially easy to educate about, coupled with the alternative of encouraging and teaching consumers how to assess foods by looking, smelling and tasting. The latter action is also one element of educating consumers in 'food skills' in terms of assessing food and managing and planning food purchasing and handling. Moreover, consumers might be crucially influenced by their surroundings. This can be general social norms that they might learn from the debate in the media, the appearance of leftover food cookbooks in bookstores or the restaurant waiter prompting whether they would like a 'leftover' bag. Furthermore, these social norms are also transported among personal networks of friends, family or neighbours and then shape personal norms individuals appropriate. This also speaks in favour of initiatives that allow signaling ethical statements through the purchase of products, for example, products that are positioned and communicated as tackling food waste (e.g. produced with surplus food). Thus, actions that influence these norms to create the potential to signal behaviour or to trigger peer influence can be successful directions.

In the Indian tradition, food is seen as a connection between the physical world and the metaphysical internal self. It not only nourishes the physical body but also influences the mind and soul. In that sense, food is considered a gift from God, 'Prasadam'. This view not only puts food on a higher pedestal – to be respected - but also places a lot of responsibility on the consumer, to ensure its optimum usage and avoid any wastage. Another element that culturally binds food with well-being is the rich bio-diversity of the traditional meal. With regional variations, the traditional meal draws from the rich local food sources as in stems, roots, leaves, flowers, bark, fruits, seeds along with local animals and birds. As noted earlier, higher diversity of locally sourced food stuffs ensures lower wastage. Also, opportunities for re-combining leftover food elements to create new

meals are much higher when sourced from a single meal tradition. Secondly, locally available foodstuffs are known to have higher shelf lives than food transported over longer distances.

6.4 Legislative approaches to reduce food waste

United States of America (USA)

The United States has several citizen-led movements related to food waste. This is also reflected in the state reaction to the issue. In 2017, more than 33 bills addressing food waste were introduced in 12 states. The salient features of the US legislation have been the following:

Liability protection

The federal Bill Emerson Good Samaritan Act shields donors and recovery organisations from criminal and civil liability arising from the age, packaging or condition of donated food. All 50 states have passed their own liability laws, many of which include greater protections. 18 states protect food banks that charge a fee to recipients. 8 states—Arizona, California, Louisiana, Massachusetts, Minnesota, New Hampshire, New Mexico and Vermont—protect donations directly to people in need. 3 states—California, Nevada and Oregon—provide protection regardless of compliance with certain labelling requirements. California and Massachusetts protect the donation of food that has passed its expiration date.

Tax incentives

Small farmers and businesses bear a significant expense to harvest, prepare and store food for donation that would otherwise be discarded. Though federal tax incentives exist, they can be difficult to claim. State tax incentives can help offset costs for donors of all sizes.

10 states—Arizona, California, Colorado, Iowa, Kentucky, Missouri, Oregon, South Carolina, Virginia and West Virginia—and the District of Columbia offer a tax incentive for food donations. Arizona offers a deduction; the others provide credits between 10% and 50% of the value of the donated

food. States can also fund food banks directly. Minnesota's Farm-to-Food Shelf program received a 7.8 crore INR or $1.1 million appropriation from the Legislature this year.

Date labeling

The labels on food products—sell by, use by, best by, enjoy by—are generally indicators of quality, not safety. Still, many consumers are understandably confused by the dizzying variety of labels, resulting in more food thrown in the trash.

Aside from infant formula, the federal government does not regulate food date labels. States have filled the void with laws that often create more confusion, not less, and some are considering ways to simplify labels and educate the public about what these dates mean. California enacted a legislation this year (AB 954) requiring the state department of food and agriculture to promote the terms 'best buy' and 'use by' to communicate quality and safety dates, respectively.

Organic waste bans

Organic waste bans prohibit entities that generate large quantities of food waste from sending it to landfills. A ban compels food waste generators to reduce their output and better handle the waste they are unable to eliminate, either by donation, composting or anaerobic digestion (the process of turning food waste into biogas).

5 states—California, Connecticut, Massachusetts, Rhode Island and Vermont—have passed laws to keep food out of landfills. Maryland lawmakers approved a study this year (HB 171) on methods to improve composting infrastructure and divert food waste from landfills. Food waste can easily be composted in a decentralized manner especially in India where over 50% of the waste generated is organic food waste. So a very easy option of diverting food waste from landfills where they will rot and produce methane, one of the most toxic greenhouse gases, is to convert food waste to compost.

In 2012, the Vermont legislature unanimously passed the Universal Recycling Law, which bans disposal of food waste, in addition to 'blue bin' recyclables and yard debris. The law phases-in requirements for both residents and businesses, culminating in a full ban by 2020. Food donations have grown by 40 percent, according to the Vermont Foodbank.

Massachusetts' ban applies to businesses that generate 1 tonne or more of food waste per week. A 2016 study found the ban has 1241.75 crore INR or 175 million USD in economic activity and created more than 900 jobs for food waste haulers, processors and recovery organizations.

California's law mandates recycling

This is part of the state's commitment to divert 50% of food waste by 2020 and 75% by 2025. California has also pledged to recover 20% of edible food waste for human consumption.

US Federal Action

In 2015, the U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (EPA) set a goal to cut food waste in half by 2030.The EPA's Food Recovery Hierarchy prioritises actions with the most benefit. Source reduction is first, followed by donations, feeding animals, industrial uses such as anaerobic digestion, and composting. Congress held the first federal hearing on food waste in 2016 and the Food Recovery Act (H.R. 3444/S. 1680) was introduced. The federal government also supports private sector initiatives. The U.S. Food Loss and Waste 2030 Champions group includes corporations such as General Mills, Sodexo, Unilever and Walmart, all of which have made a sizable commitment to reduce food waste (USEPA, undated).

Box 7

Freegans Make a Point

Freegans are people who reject consumerism and nourish themselves on food waste of various kinds both as a lifestyle and protest. The movement is particularly strong in New York. Freegans source food from dumpsters, leftovers, and foraging edible plants growing naturally. In the US, given the strong shelf-life culture, they are able to secure adequate food from retail dumpsters. While this might be a unique movement, it sharply indicts the on-going food wastage.

Similarly, in other parts of North America, such as Canada, institutions (National Zero Waste Council, 2018) are recovering unused and unspoiled food from retailers, manufacturers, restaurants and caterers and sending them to charities, in the process delivering ingredients for over 22,000 meals daily. These powerful initiatives have made a big difference in how these countries have approached a vexing issue.

The European Union

The European Commission is taking the issue of tackling food waste very seriously. Reducing food waste has enormous potential for reducing the resources used to produce the food. Being more efficient will save food for human consumption, save money and lower the environmental impact of food production and consumption.

Food waste prevention is an integral part of the Commission's new Circular Economy Package[15] to stimulate Europe's transition towards a circular economy that will boost global competitiveness, foster sustainable growth and generate new jobs. The Circular Economy Package consists of an EU Action Plan for the Circular Economy and annexure to the action plan outlining the timetable for proposed actions, and related legislative proposals on waste. The Revised EU Waste Legislation (European Union, 2018) adopted on 30 May 2018 by co-legislators, calls on the EU countries to take action to reduce food waste at each stage of the food supply chain, monitor food waste levels and report back regarding progress made.

The EU and the EU countries are committed to meeting the Sustainable Development Goal 12.3 target to halve per capita food waste at the retail and consumer level by 2030, and reduce food losses along the food production and supply chains.

To support the achievement of the SDG targets for food waste reduction in the EU, the Commission is:

[15]Details can be accessed at https://ec.europa.eu/environment/circular-economy/

- elaborating a common EU methodology to measure food waste consistently in cooperation with EU countries and stakeholders
- operating a multi-stakeholder platform (EU Platform on Food Losses and Food Waste) involving both EU countries and actors in the food chain in order to help define measures needed to achieve the food waste SDG, facilitate inter-sector cooperation, and share best practice and results achieved
- taking measures to clarify EU legislation related to waste, food and feed and facilitate food donation and use of food no longer intended for human consumption in animal feed, without compromising food and feed safety
- examining ways to improve the use of date marking by actors in the food chain and its understanding by consumers, in particular 'best before' labelling
- cooperation with EU member states and stakeholders

Through the EU Platform on Food Losses and Food Waste, the Commission is analysing in close cooperation with industry, consumer and other NGOs, research institutes and EU countries policy experts how to reduce food waste without compromising food safety, while also discussing options for possible EU actions. Prior to the establishment of the EU Platform, cooperation had been facilitated through the EU countries Expert Group and a stakeholder Working Group on Food Losses and Food Waste.

France

France is considered the gourmet capital of the world, with great snobbery associated with how the French like and approve of food. Yet, the country is also Back in 2012, France introduced the Waste Management Enforcement Law[16], which regulates the amount of organic waste sent to landfills, requiring private sector companies that produce more than 120 tonnes per year, to recycle their organic waste. Since, France has significantly lowered the tonnage requirement to 10 tonnes per year (which is less than 30 kg per day), thus extending the law to include not only supermarkets

[16]Code de l'environnement, Livre V : Prévention des pollutions, des risques et des nuisances, 2016 (revised)

and agricultural companies, but also almost the entire hospitality sector, with fines going up to €75,000 , equivalent to INR 60 lakh.

In February 2016, France became the first country in the world to pass a law prohibiting large supermarkets from throwing away good quality food, approaching the 'best before' date. Supermarkets with a footprint of 400 sq. m (4,305 sq ft) or more will have to sign donation contracts with charities or face a penalty of €3,750, equivalent to INR 3lakh.

France became the first country in the world to pass a law prohibiting large supermarkets from throwing away good quality food. Prior to the law, most supermarket donation consisted of canned food. These days the quantity, quality and diversity of donations have significantly increased. There are more fresh, nutritionally valuable foods like meat, vegetables, and fruits available further from their expiration date, which contribute to a richer, more balanced diet for the underprivileged.

Essential to implementing that law is Banques Alimentaires - a network of food banks delivering to 5,000 charities across France. The Bank now gets nearly half of its donations from grocery stores.

This policy is part of an ambitious proposal, for a national policy against food waste, 'Fighting Food Waste: Proposals for a Public Policy,' released in April 2015, by French policymakers. It offers a broad scope of measures for prevention, recovery, and recycling of food produce. Other measures that have already been enacted include the requirement for schools to teach students about food sustainability and companies to report food waste statistics in environmental reports. Another policy prescribes restaurants to make take-out bags available. There is also a ban on putting expiration dates on certain categories of goods, such as wine and vinegar. Further policies are still to follow.

In some contexts, food waste is also seen as that food which is required to be handled by the municipal waste system, creating a burden for the city. France is a case in point. In 2017, in a two-month long recycling campaign launched in Paris, 3,200 food waste bins were distributed to 120,000 residents in the capital's 2nd and 12th arrondissements. Parisians were encouraged to recycle their bio-waste, by putting carrot peels, eggshells, and tea bags into a brown recycling bin

instead of the ordinary bin. In 1998, in Berlin, citizens were given free brown bins to put in their compostable waste. To help them understand the linkage of this with their own lives, they were given asparagus grown on compost from kitchen waste.

Box 8

Paris Rewards Food Waste Innovators

In July 2017, the city of Paris identified the most innovative food waste entrepreneurs and presented them with awards to recognize their work. The innovations of the award winners included:

- Creating cookies from leftover, stale bread from local bakeries. No bakery would sell them at the end of the day-they would be trashed

- Creating jams from fruits that would be thrown out as they became too soft and pulpy to sell. However, this condition made them idea to jam.

- Creating vegetable smoothies from a slightly softened mixture of fruits and vegetables

All of these are popular foods, but made from a different base and therefore unique. That France, considered traditionally to be the capital of food snobs, recognises this innovation has much to teach the rest of the world.

Japan

Japan has enacted legislation to promote the reduction of food waste, with the aim of cutting down on the over 6 million tons of still-edible food discarded annually. Under the legislation, sponsored by a cross-party group of lawmakers, the central government will formulate a basic policy to cut back food waste that will also oblige municipalities to devise their own action plans toward that end. The legislation also calls for a 'national movement' to drive food loss reduction through collaboration between local governments, as well as businesses and consumers.

Japan's first food bank, currently called Second Harvest, receives (food) donations from manufacturers, retailers, farmers and individuals and distributes them to those in need. All of the

food is unexpired and safe for consumption. The food is given a second life by distributing it to welfare agencies, orphanages, women's shelters, the homeless and others in need of food security. According to the Japanese government's data, in fiscal 2016, 6.43 million tonnes of food was wasted in the country, with half of it comprising food from the commercial sector.

Box 9

Japanese Behavioural Change for Preventing Food Waste

In Japan, behavioural change is an important focus for preventing food waste. Are-engineering of accepted social protocols is a key focus here. A manual, called the Shimatsu-no-Kokoro Manual, is based on the Japanese mindset to be motivated to take good care of things from the beginning to end, to enrich our personal life. The manual explains to users that they must:

- Only order food according to guests and not over-order for fear of running out.
- Feel free to offer the last piece of food to others
- However, if no one eats it, it is fine for them to eat it
- Learn to share large plates with others (without hesitation)
- Learn to ask other tables in a banquet setting for food they may not be consuming
- Spend the last 10 minutes of a formal dinner to finish leftovers
- Eat food while it's hot, as it is supposed to be relished
- Since doggie bags are not yet a widespread concept in Japan, the manual also encourages consumers to request for these.

The city of Kyoto has been on the frontlines of fighting food waste. Here too, the focus is on consumer behaviour.

Legislative challenges in Japan

Liu (2016) found that Japan's Food Waste Recycling Law was enacted in 2001, revised in 2007 and again in 2015 and has a 5-year implementation period to be operational by 2020. This law mainly targets food waste generated by food related industries and businesses (e.g. food manufacturers,

wholesalers, retailers, restaurants), requiring these actors to promote the reduction of and recycling of food wastes. At the same time, national authorities such as MAFF and MOE have set recycling/reduction targets, developed measures to promote recycling, produced data on food waste generation and recycling rates across the country, as well as developed criteria to evaluate the performance of food-related industries and businesses. The levels of the targets have been increased and their scope has been expanded since 2001.

Food manufacturers, which generate the largest amount of food waste and also have the largest potential for further waste reductions, have already achieved high rates of recycling and low rates of waste disposal. Part of this observed efficiency may be due to the fact that most wastes from food manufacturers are categorised as inedible or an edible part of food loss that inevitably occurs during food production, and which are easier to control, reduce, separate and recycle as animal feed and fertilizer. In fact, more than half of this food waste represents marketable goods, which have been sold commercially as animal feed or fertilizer. In other words, there exists little room left for further reducing and recycling of food waste.

Food waste recycled into animal feed provides a means of optimising the use of calories and nutrients, in turn contributing to improvements in production efficiency as well as supporting overall self-sufficiency. However, the scale of the crop/animal farming system in Japan is declining and the market for feed/fertiliser recycled by food waste is considered to be limited, if no actions to resuscitate the agricultural sector are taken.

With the exception of food manufacturers, the recycling rates for food industries have not met their recycling targets: this is especially the case for restaurants.

Although almost half of the food waste treated by incineration/landfill is associated with households, there has been little behavioural change towards food waste reduction at the consumer level. Although the Food Waste Recycling Law itself is largely concerned with downstream efforts to tackle food waste, emphasising the importance of consumer waste reduction and recycling initiatives, there exists huge room for improvement, as households continue to discard a large percentage of food waste.

Existing laws/measures do not address food waste that is generated at the farm level, although this aspect of food waste is more easily recycled as animal feed and fertilizer.

In the practice of recycling, the appropriate method of recycling should be based on the quantity and quality of waste. Recycling methods are prioritised in the Food Waste Recycling Law, firstly as feed and compost fertilizer, followed by heat recovery, dewatering and drying. However, this priority setting is not suitable for the food waste generated downstream in the food supply chain such as waste generated by households, restaurants, retailers and so on. This waste is characterised as a dispersed emission source, comprises a relatively low mass, and is also highly heterogeneous in content. Heat recovery from mixed wastes by methane fermentation should take precedence over recycling as feed and fertilizer, according to the conventional waste management hierarchy. However, few local governments in Japan own or operate methane fermentation facilities.

Waste disposal is carried out at the municipal level, and incineration is the main treatment method for municipal solid waste including household waste in Japan (80% in 2012). Although waste separation practices are well established in Japan, few local governments currently collect household food waste separately from other waste. This would be an essential step to promote the reducing and recycling of food waste generated by households.

Japan's current legal and regulatory frameworks comprise general categories of food waste. However, considering the complexity of food waste generation, more nuanced policies are necessary, such as including socio-economic and cultural aspects of food consumption patterns. For example, policies that include residents into the loop of food production, consumption and waste management, not only as consumers, but as a key link in the social chain of actors represents an important potential driver.

United Kingdom (UK)

In the UK, besides policy reflecting, the EU commitment has focused on the voluntary Courtauld Commitment, (so named as it was first discussed at the Courtauld Art Gallery in London in 2005). It

is an agreement between grocery retailers and suppliers to reduce household food waste, packaging and supply chain waste. It is based in part on the Packaging Covenant in The Netherlands, a voluntary agreement among packaging producers and importers that ran from 1991 to 1997 and set waste reduction and sectoral recycling targets. Companies signing the agreement agree to take action that contributes towards the overall targets. They also agree to report annually to WRAP[17] on their progress. The business case for companies was built by WRAP on the basis that involvement would open up for them opportunities for increased innovation, potentially reduce their costs, and would cater to their customers' interest in reducing the amount of packaging they buy, as shown by surveys.

WRAP acts as the independent convener of the agreements. It collects company data on changes in waste, accumulates it for all signatories and publishes independently audited reports annually on the progress of the sector as a whole rather than for individual players. This process not only encourages pre-competitive collaboration between companies, but also requires companies to measure their own performance in detail, often uncovering opportunities for further improvement.

Pakistan

In battling food waste, Pakistan's Punjab province has promulgated the Marriage Functions Act, 2016.[18] While the Act has wider scope as it primarily targets control of ostentatious displays in terms of lighting, fireworks, dowry, gifts and other expenses, it has an interesting view on food served during weddings. It mandates serving only one dish to persons attending a wedding event. The definition of 'one' dish, as described in the Act includes one salan (gravy based preparation), one rice dish, one salad, hot and cold drinks, rotis/naan (and other breads) and one sweet dish. While the Act puts the liability on the parents of the couple, it also places parallel responsibility on the hotel/caterer or organizer to ensure compliance. The violation of the Act is a bailable and cognizable offence, punishable with prison sentence of one month or fine of 50000 Rupees, besides forfeiture of the violating items – food, gifts.

[17]**WRAP** (Waste & Resources Action Programme) is a UK registered charity. It works with businesses, individuals and communities to achieve a circular economy through helping them reduce waste, develop sustainable products and use resources in an efficient way.

[18]Marriage Functions (Prohibition of Ostentatious Displays and Wasteful Expenses) Act, 2018 as available on http://www.senate.gov.pk/uploads/documents/1535452423_780.pdf

India

Although the contexts were slightly different, India has experienced a series of regulations, which were aimed at curtailing ostentation, wastage of food items and observance of general austerity in social events like weddings, celebrations and funerals. Perhaps the most well-known was the Delhi Guest Control Orders of 1968, 1972 and 1976. These were matched by similar rules in states like Assam, Jammu and Kashmir, Andhra Pradesh, Maharashtra and Rajasthan. These put strict limits on number of guests that could be invited and the meals they could be served. **However, these lapsed and were enforced under extreme political and economic conditions.**

Similar examples exist in self-regulation by various caste and community organizations or '*biradaris',* which advise members on number of guests as well as number of dishes to be included in various social, religious and community feasts. While such cases were numerous in the past, the effective control of such bodies and their advisories has diminished in the recent years, due to social changes. Ways of reviving the community aspect of social events need to be explored.

In the recent past, the Supreme Court of India had also expressed need for regulation of guests and food being served at weddings (Mahajan, 2018). The Government of Delhi had drafted a two pronged policy to curb huge food wastage in weddings and other social events. The policy envisages limiting the number of guests and availability of food at weddings. Secondly, it also plans to mandate that hotels/caterers have institutional level contracts with voluntary organisations to collect and redistribute surplus from such events, as envisaged under the Food Safety and Standards Act (2006). However, these are not yet policy and are still being debated.

The Indian Government has made many efforts to rein in food wastage but clearly, the depth of the problem is such that the impact of these efforts is hardly up to the mark. In order to make progress in reducing the burden of this problem, the government needs to primarily contain the excessive wastage in transportation and improve storage facilities that are currently 50% less than required. Besides this, the government must also focus on food processing technologies that are both

advanced and affordable so that food preservation practices can be encouraged thereby saving food from wastage.

India should also take a cue from global practices that are both unorthodox and innovative in order to tackle the food wastage problem. For instance, France has passed unanimous legislation requiring supermarkets to either give unsold food to charity or send it to farmers for use as feed and fertilizer.

India can effectively use technology to script a new chapter in prevention of food wastage. The government can speed up research in Nano technology with the help of which eco-friendly and healthy food preservation applications can be invented that are helpful in preserving food for longer duration and keeping farm produce fresh. In addition to these efforts, the government must make it mandatory for the food retailers across the country to adopt technology standards that allow incentives for the customer to purchase perishable products that are approaching their expiration dates. This will help reduce food wastage, maximize grocery retailer revenue, and effectively reduces the global carbon footprint.

Box 10

India's Ecologically Sound Food Tradition

Till just recently, Indians ate many more parts of both plants and animals than they do today. In Rajasthan, for example, watermelon rind was used as a food because it was also a source of water in the desert. Peels of peas, pumpkins and even bottle gourds were all eaten. Many more parts of, even a chicken, for example, were used. Claws and legs were cooked. Goats' lungs were also sold till recently in mainstream butchers' stores. Many such foods followed traditional recipes that harvested both their nutrition and their value as edible materials. This prevented food waste and ensured efficient food consumption.

As Indians discover and delight in traditional Indian home food, it is a good opportunity to create knowledge and excitement of this aspect of our ancient wisdom.

7. India's Indigenous Traditions of Waste Reduction

India's waste reduction traditions have historically been due an understanding of the scarcity of resources and an ethic of preserving them as a way of life. Such preserving includes wasting less. In Rajasthan, for example, watermelon rind-based food, such as cooked dishes, are attributed to the understanding that there in the desert ecosystem, a fresh fruit with so much water had to be consumed in all its parts. Similarly, where quilts, or *razais* are still stuffed with cotton, they are repaired every few years. In this case, the service provider opens up the quilt and re-fluffs the lumpy cotton, readying it for use year on year. Across urban India, cobblers, called *mochis,* repair shoes that would otherwise be discarded in other developed parts of the world. In automobile hubs, auto parts are re-used to create entirely new pieces of machinery used in the agriculture sector. The *rafoogaar*, a ubiquitous presence till a decades ago, darns and repairs textiles of all kinds. Even today, it is possible to see the term 'invisible darning' on signboards. Mobile repair shops are also common many emerging from what were previously electrical equipment repair shops. Several of these are 'small traditions,' to borrow a term from sociology, 'which are highly local, practiced by an entire community and embedded in it. Making ropes out of old *sarees* and *chunris* in Rajasthan is one such case in point. It is not even possible to document the thousands of other ways people prevent waste in their lives all across India. Each of these cases are based on finely honed skills, practiced by artisans, often overlooked as the specific environmental services category that it is.

When these practices are undertaken as a livelihood, it is mostly in the informal sector. Such actors are an essential part of the Indian waste reduction success story, but they struggle to fit into a shifting type of urbanization. In all cases, they cite a decline in services. The 20 case studies in this report were developed after lengthy interviews with these actors. Some of the key challenges and needs identified across the sector by the interviewees themselves were:

- Inaccessibility to appropriate space: Most of those interviewed mentioned that their livelihoods required spaces that were visible to the public (including potential clients). These spaces were identified as being accessible to their clients, clean and safe to work in, and part of the market or colony, rather than far away from them. The request was for identifying these spaces in every ULB on a long-term, based ideally on existing spaces.

Such spaces have evolved out of trial and error and serve the service provider and the community well.

- Market Linkages: Several service providers, such as knife-sharpeners, pointed out that their services were still required, but poor market linkages were a challenge. Gated communities and a change in neighbourhood relationships were cited as some recent challenges. They asked for such linkages at an institutional level via local governments and through RWAs and through government schemes.
- Awareness: Most of the service providers pointed out to decline in demand, which they attributed to a drop in awareness of both the service itself as well as poor understanding of the value of their services. The consensus was that the public would like to try their services if they were aware of these.

8. Taking Steps Ahead: Action Points

This report has analysed three sectors plastic waste, textile waste and food waste and one framework of traditional occupations though the analysis of data, discussions with experts and a review of literature, and has been discussed earlier in this report. It has also identified areas where there are numerous opportunities to either all together stop or reduce waste generation, or optimally recycle it where it is inevitable that waste will be generated. A number of lessons and areas of action are identified. While regulations presently do not exist in all areas, there are areas where policies can be developed, such as regulatory standards for washing machines for synthetic fibres, or near expiry foods. However, implementation can only be successful, if consumers are willing to embrace it, and there are systems and technologies in place to create the possible systems and alternatives to reduce waste. Given the Indian context, these also provide an opportunity to tackle existing challenges of livelihoods.

Any actions on waste reduction have to be undertaken in a Mission Mode, as it involves multiple agencies and tasks, which have to be directed to act in sync with each other, with other projects and based on targets. It is suggested that waste reduction should become the top priority of the Swachh Bharat Abhiyan. This mission should be set up as a special unit in the ministry, with specially designated nodal officers across relevant ministries and states.

Waste is still an externality, and there is only little incentive in acting to solve the problem. One successful incentive has been the Swachh Sarvekshan, which names and praises, and names and also incentivizes. Lessons can be learnt from this and included in all sectors for waste reduction.

- The Niti Aayog SDG India Index, 2018, could incorporate waste reduction in a new section comprising SDG 12. This will spark competition as the baseline is set for each one.
- Based on the measurement of waste reduction, states – both big and small - should be ranked and rewarded. Rewards can include fiscal means to further reduce waste, scale-up, etc.

- There is also a need to catalyze public opinion to reduce waste. An intensive campaign to encourage people to Have Less is essential in this aspirational age. Using informal sector services for waste reduction should also be seen as desirable and on-trend, for widespread public acceptance.

The action points are divided into three categories: Short term, Medium term and Long term for all three sectors of waste

8.1 Plastic and Plastic Waste

Plastic waste reduction is a burning need today. The study has shown many ways by which plastic waste reduction is being tried today. Many countries have tried banning various kinds of plastics, from plastic bags to straws, in the last several years. Some have worked, but others have not.

4 key approaches have been used till now:

- Bans: eliminating the use in its entirety. However, discouraging or limiting access – as in the case of the straw ban are seldom written into law.
- Charges: Levying charges for the use of a certain product. The flip side of charging would be to provide incentives or encouragement of non-usage. CDL (container deposit legislation) is one form of incentive aimed at recycling not reduction per se. It is effective albeit expense for implementation.
- Extended Producer Responsibility (EPR): Used in India for plastic and E-Waste. Found to be hard to implement without other measures. Best used for plastics with no commercial value.
- Recycling: Collecting and recycling the product to ensure lesser amount is mined from the world's depleting oil resources and extracting more use from the product by keeping it in circulation for longer periods.

Some of the action points that can further strengthen reduction of plastic waste are given below.

8.1.1. Short Term Action Points

a. Policy and Regulatory Instruments

There already are a number of policies and regulations for the management of plastics and plastic waste. Bans, which are often considered, can be put in place though legislation and implemented through regulations, as also can other ways to manage plastic waste. However, it is not enough to legislate bans or reduction in plastics, without ensuring enforcement and creating incentives or disincentives to encourage a reduction in the use of the material. Therefore, all policies created will need further actions to ensure their effectiveness.

Harmonise the Rules and Policies

Rules related to plastics differ across various states. This creates challenges for an implementing agency or brand owner working or designing products for sale across India. National harmonisation must reflect consistency on sizes and materials disallowed and undertaken by the MOEFCC.

Extended Producer Responsibility

EPR is already being used India for plastics (and E-waste). Several companies are t must be strengthened as follows:

- Many companies have formed groups to collect and dispose off waste plastics. However, their integration with the informal sector is poor. The informal sector is already able to handle high value plastic, feeding it into formal sector recycling for most part. An integration of these will only upgrade EPR. This can be done as follows:
  - EPR must work with Urban Local Bodies to support and invest in decentralized Material Recovery Facilities.

-EPR must also work with State Pollution Control Boards to set up decentralized plastic recovery units that are able to extrude and mould certain plastics, particularly LDPE and HDPE.

-Recycling must be included in the list of Micro, Small and Medium industry and all help be extended to them by the relevant ministry.

-The prices for virgin plastics have been globally at a low as oil prices are falling. These are likely to continue. However, this makes recycled plastics as expensive or more expensive than virgin plastics, killing the market for recyclables. This jeopardizes the market for plastic waste. Under the circumstances, the several recycling units have closed down, as recycling is not a financially viable activity. EPR as well as other government actions must invest in the recycling units, in order to give them a boost and fiscal incentives to open and function. These can include consent to establish and consent to operate on priority basis, help to meet pollution control norms, tax rebate for 3 years. Furthermore, the pellets will be converted into usable products. These could be synched with government needs (such as bins) for state procurement to help in uptake. Some funds for these can come from EPR and others from taxing the virgin plastic industry which is currently out of the focus on plastic reduction.

- The existing EPR Mandate should be expanded in the Plastic Waste Management, 2016, Rules. EPR must apply to multi-layered plastics, Tetrapak, styrofoam and textiles with any number of synthetic components. This must apply to brand owners, manufacturers and e-commerce. The laws should be notified within 9 months of this year. Guidelines must also be issued, with year wise targets to collect, recycle and report back.

Companies such as ITC, Unilever and Nestle are acting under the EPR framework and financially incentivizing the informal sector to collect single use plastic. The Coca Cola Company is also investing in collecting plastic waste with the help of improved occupational health through micro-infrastructure for waste collectors. These are important first steps in implementing EPR for single use plastics.

Developing Alternatives to Plastics

Many bans have failed due to lack of available alternatives. It is impossible to sustain a ban without providing alternatives. Alternatives can be both material alternatives and process alternatives, depending on cultural viability. However, there has to be a continued supply of these. Investments for starting these up as micro or medium industries may be needed as well as help for marketing. Government may need to invest in making them cheaper till scale is reached. Process alternatives include *Bartan Bhandars*, or Crockery banks, to displace plastic crockery used for various functions and redesigning retail through zero waste dispensing systems for some products are some cases.

A process must be set up where every alternative is first verified by a state level task force, based on national guidelines. Any citizen can appeal against an alternative to this task force as well. The task force at state level will be set up comprising people from the state government and agencies outside government, to verify the bio-degradability, safety and possible challenges of the material as a plastic alternative and issue a go-ahead. The task force can be state-wide, with representations in cities. All state task forces should be able to communicate with each other for mutual strengthening through a formal process.

b. Building ties with the informal sector

The informal sector comprising wastepickers, traders, itinerant buyers and others are amongst the few workers willing to handle waste, including waste plastic. They are able to segregate plastic into upto 52 categories, enabling their recycling, where the technology exists to commercial scale. However, despite the rules, their work has been poorly integrated in plastic waste reduction. Some key ideas for expediting this include :

- Decentralized Material Recovery Facilities run by wastepickers across every ULB
- No MRF to handle more than 5 tons per day.
- Decentralized recycling into pellets of specific plastics, meeting pollution control norms
- The informal sector must be mapped in every ward, across their various roles in the chain. Each one must be registered and given an I card, which entitles them to social security (such as ration, pension, accident and life insurance, and quality health care)

- All waste workers, including those in the informal sector, to be declared essential services.
- Recycling to be declared an essential service.

c. Influencing Behaviour

As the KAP survey suggests, there has been awareness on the impacts of plastics either though the national government's Swachh Bharat Mission, or from other media actions. This must be used further to create responsibility among consumers and lead to public participation to reduce plastic usage. Campaigns have to be at least state level, in sync with future regulation and building public. They should also open the eyes of the public to the informal sector.

8.1.2. Medium term action points

a. Policy and regulatory instrument

Plastic Bans

Bans are not a stand-alone answer for India. However, this would need to go alongside with development of low cost and easy to get alternatives, if the bans are to be successful, and mobilizing public opinion.

Global experience suggests that, the public does not tend to automatically adhere to bans or comply by new rules. In fact, all bans are ignored as a first reaction. They have not only to be policed, but awareness and strategic implementation are important. However, according to a research on bans, lessons for India for single use plastics could be:

- Implement bans phase-wise, with the easiest items first.
- Seek alternatives and advertise and promote them widely.
- Some single use plastics (SUPs) don't have alternatives, such as small sachets, and should be put in the final phase of the ban.
- Bans should be extended to all non-medical-use plastics and not merely restricted to plastic bags.

In Phase 2, ban could be implemented on:

- Coffee cup lids, plastic plates, plastic and thermocol glasses, spoons, folks, knives, plastic lined glasses, PET water bottles of less than 200 ml. Adequate alternatives need to be ready. Crockery banks should be useful as well.
- Wet wipes, flexi-banners (widely used for advertising)

Clarify and verify alternatives

- Often, bans do not clarify what is precisely being banned. The Maharashtra Plastic and Thermocol Products (Manufacture, Usage, Sale, Transport, Handling and Storage) Notification 2018 was amended on April 11th, and again on June 30th 2018. However, 'non-woven' material ban was not included leading to misinterpretation and a proliferation in the use of non-woven plastic bags that resemble cloth bags finally leading to the government releasing a pictorial representation of banned materials. In the case of Delhi, several shops were flooded with woven HDPE bags, which were plastic but looked like textiles. Therefore, there will be a need to periodically review alternatives put in place, as new items appear as alternatives, and identify if they are appropriate for use.

Strengthen Enforcement

It is expensive and difficult to police for compliance. Experience suggests that, in Tamil Nadu, the ban was weakened when policing stopped. In Ireland, the pricing of plastic bags also slipped when policing was stopped.

- A special force with state pollution control boards to handle plastics is recommended. Funds from fiscal taxes and via EPR may be used to ensure such teams are hired and located within urban local bodies and Panchayats.
- Moreover, only those citizens who are trained and specifically selected for a period of 2 years should be included in monitoring. They should however not be given powers of fining or correction. Local level organizations, and representatives such as councilors at wards

and Sarpanchs, should be trained to monitor. Citizens groups, such as the Lions' Club, Rotary Club, NGOs, Schools, etc. may also be called into action to monitor and report absence of compliance for enforcement.

b. Fiscal Instruments

Fiscal instruments can be used to discourage and create disincentives on the use of plastics. It should be mandatory to charge a minimum surcharge for selected items till the ban is completely effective. A diverse committee should identify fiscal measures for plastics, with a focus on non-recyclable plastics. These can be at the level of brand owner and retail (straws, plastic bags, food containers etc). Implementing can be for the medium term. The possible actor involved can be the National Institute of Public Finance and Policy (NIPFP).

c. Influencing Behaviour

Any reduction in use or bans, can only be successful if the public understands and supports it. Therefore, let the public know how plastics are damaging the country. The big picture is as key as any other awareness. People respond to images. Therefore, do not miss a chance to tell the story beautifully, powerfully and with a You-Can-Make-A-Change tone. Awareness can lead to public participation. It also makes clear what the laws are. Besides, awareness means several organizations can be made part of the implementation.

d. Technologies and Entrepreneurship

A DST lead initiative should identify existing and emerging recycling technologies for plastics. Ongoing research should be mapped to understand the state of research for recycling and reuse and identify the most promising technologies to invest in, and further developed and supported. Small scale recycling can also be encouraged to meet the industry standards. However, reduction of plastics by blending into natural fibres is not to be encouraged.

8.1.3. Long term action points

a. Policy and regulatory instrument

Ban on SUPs

Multi-Layered Packaging (MLPs) can be banned in the long term:

- Recover materials from multi-layered plastics (MLPs)
- Identify other forms of dispensing edibles currently in MLPs, through dispensing units etc, to minimize packaging

b. Technology and Entrepreneurship

Presently, reducing packaging waste is hard to replace as well as recycle. While several materials are being researched, funding for both design and materials that reduce plastic waste is essential. DST should hold “dematerialization challenges” that encourage the development of technologies and bring them to commercial scale.

8.2. Textile waste

8.2.1. Short term action points

a. Policy and Regulatory Instruments

Reducing pollution by synthetic fibres

- Controlling micro-fibres at source: Micro-fibres from synthetic clothing are known to be released via washing machines and hand washing both. In India, it is impossible to control this after sales. However, given that most of the clothes release maximum micro-fibres and microplastics in the first ten washes, laws should require that garments containing synthetic materials should be pre-washed in the manufacturing unit 10 times, using techniques to save water and capture and sequester micro plastics.

- Additional standards for washing machines: About 6.5 million washing machines are in use in India[19], While a majority of Indians still wash clothes by hand, pollution from synthetic fibres can be prevented in part by a law that requires micro-plastic fibre capture systems in every washing machine. The filters will be required to be treated as hazardous waste as microplastics are otherwise difficult to contain and can be hazardous due to additives.
- Consumer information: Garments can be labelled with the instructions on their disposability instructions for consumer awareness.

Elongating product lifecycle

Traditional micro-entrepreneurs, such as Rafoogaars (highly skilled persons specializing in the near-invisible skill of darning) and roadside tailors, who undertake repair, also require a boost. These are in the form of space, recognition for their work and upgradation of skills for wider application.

b. Influencing Behaviour

Green Procurement

The government can also make an effort though its systems, to consider green procurement. Given that government itself undertakes procurement for a range of uniforms, soft furnishings, etc.- these should be mandated to be of natural fibres only. If done on scale, it will also positively impact pricing, making it more competitive.

c. Technical and Entrepreneurship

The government, through its Department of Science and Technology (DST), as well as other arms, should initiate technology innovation that will be

- Using fewer synthetic textiles to make garments - to reduce the filaments per garment

[19] *https://www.tvj.co.in/washing-machines-the-fastest-growing-among-ha/*

- Harvesting other materials for sustainable textiles while identifying the carrying capacity for harvesting. These include banana fibre, spider silk, etc.
- Recovering fibres and filament from old clothes is not yet the norm. Investment in this technology to bring it to commercial viability is an important way to reduce the waste from synthetic textiles.
- Having Invest India include waste reduction in its portfolio.

8.2.2. Medium term action points

a. Policy and Regulatory Instruments

The objective of any policy or regulatory framework on textiles should include steps to reduce textile waste per se and prevent synthetic fibres from entering the eco-system as microfibres.

Reducing pollution by synthetic fibres

- India must create recycling and material standards for synthetic-fibre based textiles, including clothing, that every brand and manufacture must adhere to. Aspects of these standards should include micro-plastic and micro-fibre emission standards, standards to monitor these and processes to handle captured plastics.

- Labelling: India must introduce tabled bills that recommend advertising the proportion of the constituent fibres. The advertising would go on the labels of garments to detail the percentage of synthetic fibres in their fabric. These would also serve the purpose of informing consumers about the dangers of microfibre shedding, as well the ways in which they can reduce the damage. This kind of advertising can operate under the same principle of tobacco and nicotine advertising, which requires the products to have labels that give a warning to consumers.

Pre-Loved Garments and micro-enterprises

Exchange of clothes and increasing the life of garments may also be considered, to reduce waste in

the longer run. Various actions can be considered, some of which will also help with providing livelihood opportunities through micro-enterprises.

- Set up a small fund for a starter kit for such micro-enterprises. This can include materials and advertising for a limited time, on social media etc.
- Encourage a clothes exchange stall at all green meets where the government is a partner, even if there are few takers.
- Create Guidelines for second hand clothes businesses to increase market confidence

Fiscal Actions

- Creating incentives such as tax breaks, reduced or no GST and special packages for entrepreneurs involved in recovery of synthetic materials for circular pathways. This should not include waste-to-energy and end-of-life and end-of-pipe technologies, as there is little innovation here.

b. Influencing Behaviour

- Recognising fast fashion as a major driver of textile waste and pollution, the government, in tandem with civil society organisations, must launch awareness campaigns to influence consumer behaviour. It is neither possible nor desirable to entirely eliminate synthetic textiles. Therefore, a reduction strategy, that reduces the wastage and discarding of usable textiles may be considered.

Use of Alternate Fibres

There already exist a variety of natural fibres, such as cotton, linen and silk, and new fibres like banana and pineapple fibres. Hence, natural alternatives are not hard to find. However, there will be a need to have a concentrated effort, where possible, to choose these alternatives over synthetic ones. Some of this can come though increasing demand through consumer awareness and targeting consumer behaviour change.

c. Technology and Entrepreneurship

Synthetic textiles that are already in existence have to be reduced and prevented from being dumped. Technology and R & D is key to going forward. In the case of synthetic textiles, the absence of commercially available and viable technology prevents its recovery and reprocessing, resulting in end-of-life textiles being dumped. While the government already has schemes to promote innovation, more investment is required in the sphere of textile pollution. Some technologies to recover strong fiber from polyester for re-manufacturing synthetic fiber exist, but these are not at a commercial scale.

- Technology is not enough. It has to be coupled with incentives for innovators. These can involve tax breaks, subsidies as well as supporting research in the same sector. As the eco-system matures, Invest India and the Ministry of Textiles must foster such innovations.
- Depending on the cost of technology, and capital and operational costs, the focus should be to embed such entrepreneurship in the micro, small and medium enterprises of the country. This will help socialise the technology and entrepreneurship, create livelihoods and further fight poverty. This sector contributes to 6.11% of the manufacturing GDP and 24.63% of the GDP from service activities, as well as 33.4% of India's manufacturing output. They have been able to provide employment to around 120 million persons and contribute around 45% of the overall exports from India.
- Identify existing and emerging recycling technologies. Ongoing research should be mapped to understand the state of research for recycling and reuse and identify the most promising technologies to invest in. The actor involved should be the DST.
- Set up a global competition, open to any company or consortium, with state facilitation on these lines, to roll out in India, under Make in India.

8.2.3. Long term action points

a. Policy and regulatory instruments

Fiscal Actions

- Design houses, start-ups and those using 100% natural fibres and materials across their entire range should be given a special tax benefit to encourage a shift. In addition to this, regular and **strict audits** can be conducted to evaluate the production process of companies, which could help dictate the terms of engagement with them.

Use Extended Producer Responsibility

In the case of textiles, EPR, if defined with targets, can be used effectively as a tool to recover the post-consumer materials. Meeting these targets can be linked with public recognition, to set apart the responsible companies and encourage them and the others. In order to meet this targets, retailers and brands in the apparel sector may be given fiscal benefits if they meet targets on time. Any EPR system developed may also encourage a policy of repair amongst brands that follow it abroad and brands that sell products for the long term. This will require clients to send in certain clothing intended for long term use, for repair and its return by the company.

- An EPR framework for brand owners manufactures and retail manufacturing or selling any form of synthetic fibres to handle such materials that stay in the country should be created. This includes take back, reprocess or use the materials in other ways as authorized by the Central Pollution Control Board (CPCB). This will also extend to clothing and materials with upcycled plastic content. All companies and brands to be covered under this. This will include recycling 100 percent of the synthetic textiles and accessories (such as buttons) within 10 years to prevent dumping in landfills or plastic pollution.

8.3. Food Waste

At the farm-end, food production covers activities involving harvesting and sorting. During harvesting, technology can play a critical role in efficiency of the harvesting process, as less than efficient processes may leave a percentage of the crop in the field. Another factor could be timing of the harvest. A farmer would want to time the harvest with market dynamics. Better information on prices and access to various buying centres would ease decision making on timing of the harvest. A certain portion of the harvest would be 'unmarketable' due to natural anomalies in shape, colour, size and other physical deformities of the harvest. This along with crop-residue is typically left in the field, burnt or used as animal feed on the farm. Mechanisms and markets for such portions may be developed to better utilise them. Options ranging from composting to conversion to fuel and energy for use on the farm can be explored. These could be explored as a collective facility, as small farm sizes may not justify individual investment.

Post-harvest activities involving handling the produce, storage and logistics comprise the next critical stage of the food production chain. As has been reported earlier, a significant portion of the harvest is lost to inadequate or absent storage facilities. Prioritising development of storage facilities and allied transport and communication networks through various agencies is critical. The private sector – especially the food processing industry - can play a big role in developing this supply chain element. Indigenous technologies like evaporative coolers, HDPE storage bags, metal silos and containers can be employed to enhance shelf-life of perishables like fruits and vegetables. Low-carbon technologies can be explored for development of efficient cold-chain systems. Skill development in handling and sorting can also lead to significant reduction in food loss.

In India, there is considerable scope for development of food processing and packaging industry to take up market slack, balancing the supply and demand inconsistencies. However, the food processing sector accounts for a significant share of food loss and waste due to heavy mechanisation and requirements of standardisation. Here, there is a need to re-engineer the production processes to enhance efficiency and creating nets to catch process rejects. Stricter

legislation can play an effective role in monitoring and control of various processes aimed at reducing, recycling and reuse. Suitable incentives and economic 'nudges' can be created to improve processing, packaging, labeling to keep food usable for longer and optimize package/portion sizes. Food waste in India can be tackled through the following action points in the post consumer and post retail stage, the focus of this study.

8.3.1. Short term action points

This study limits itself to post consumer and retail waste as several optimal steps have already been initiated by the government to prevent food waste at the farm and storage level. It does not consider food composting as a means of food waste prevention. Given the far reaching social, economic and environmental impacts of food waste, it must be tackled in a mission mode, under the Swachh Bharat Mission with involvement of the Consumer Affairs Ministry.

In the case of food waste, there is a need to look at the food production, distribution and consumption process and practices to examine options for reducing food loss and waste. Much has been discussed about the production and distribution. The Make in India has 6 schemes that focus on waste reduction at the food production, storage and distribution level[20].

a. Policy and Regulatory Instruments

The management of food waste, its reduction and possible ways to use unsold food would require innovative ways to address it though policy and regulatory systems. A variety of regulatory instruments, including setting targets and measuring waste based both on the SDG and India's own plans may be considered to reduce food wastage, with some of this included in the Swachh Bharat Sarvekshan.

[20]*More details can be accessed at http://www.makeinindia.com/six-schemes-adopted-that-would-reduce-waste-benefit-farmers*

Setting Targets and measuring waste management

Waste reduction must be based on clear targets, based on both the SDGs and India's own plans. This study has identified means to measure the impact through the Swachh Bharat Sarvekshan. The Sarvekshan must include waste reduction as a parameter for every municipality. This parameter must not count recycling, waste-to-energy or composting.

Reducing wastage

- Unsold farm crop in good condition is sometimes dumped due to economic reasons. Depending on the specific crop and its propensity to be easily used without complex processing, the education department should be drawn in to enable these local foods to be used in mid-day meals by the contractors
- Unsold foods nearing their expiry date must be sold off at a discount 48 hours befre the date, to enable its timely purchase and safe consumption. They may be given off for instant consumption or consumed in-house for free in the last 2 hours of operations on the day of their expiry to prevent their wastage. Distributors and manufacturers must be enabled to realign plans to allow for this or make their own plans for waste prevention. Every formal retailer must have a shelf for such products for transparency.
- Municipalities should issue orders for retail stores, specifically raw fruit and vegetables, to giving away unsold foods that might otherwise go bad. These must be reported annually and begin to feed into the SBA
- Every formal sector retailer or chain store must submit a plan to the local municipality for the prevention of food waste across the food types sold in order to get licensed to operate. These may include improved storage, selling food at discounted rates before its expiry, awareness, and tie ups with food banks. Every formal retailer must have a shelf for such products for transparency.
- Municipalities should encourage waste food being sent to registered piggeries or as other animal feed as appropriate, to allow for food to be used as animal feed instead of dumping.
- A special focus must be on caterers to prevent food waste.

b. Influencing Behavior:

- Waste reduction can also be encouraged by recognising and rewarding municipalities that have demonstrated 50% or more reduction of food waste.
- Making prevention of food waste part of the Swachh Bharat Sarvekshan, to foster awareness of it as an urgent issue.

Creating awareness and demand to reduce wastage among consumers

- Leadership builds trust: All government sponsored meals must contain one item created from a typically unused part of a plant to break hesitations and fears about untested foods and encourage culinary innovation around these.

8.3.2. Medium term action points

a. Policy and regulatory instruments

Possible crops being dumped due to low or no prices can be instead diverted for mid-day meals, if there are no quality problem, and retails stores with raw fruits and vegetables in urban areas may also be linked to feeding or food donation programmes. In urban areas, improving food storage, tie-ups with food banks, or even providing unusable food for animal feed, is a step ahead.

b. Influencing Behaviour

Food is a highly personal choice. It is also consumer driven. Hence influencing this segment and building a strong constituency of support amongst the middle classes is the foundation for all other steps. Some actions are as follows:

- A multi-pronged campaign to help people understand negative impacts of wasting food.
- Working with influencers in food world like chefs, restaurant owners, food critics etc. to:

- Embrace the culture of eating more parts of each food, to reduce wastage as well as re-discover India's ecological heritage of food.
- Reduce aspects of food plating and garnishing that cause food waste. This including elaborating carving and plating and dining décor from edible items
- Standardise portion size overall and train constituencies on this
- Develop a prevention protocol for food types that are wasted after being served.
- Agree to serve guests smaller portions if they request, at no price difference
- Give away fewer perishable foods for charity. These can include bread and other identified foods.

India has rich tradition of using various parts of food for different purposes and reusing food within households and for feeding stray animals and birds. This culture can be reinvented through dedicated campaigns on socio-economic benefits of reusing food in different arenas than wasting it.

Creating awareness and demand to reduce wastage among consumers

Thought leaders, particularly in the restaurant sector, should be able to identify a range of voluntary agreements for themselves and set standards based on industry capacity. These should be widely publicised.

c. Technology and Entrepreneurship

- Preventing food waste can spawn start-ups, as we have seen in the case of Paris. India already has a rich history of eating parts of plants now wasted. Foods – both old and new—can be part of commercial enterprises. They will need financial and market help to start - up and build consumer confidence. The Ministry of Micro, Small and Medium Industries should set up a programme to encourage enterprises in this sphere.
- Farmers often receive reduced amounts for their crop, and eventually dump it as it is no longer viable to sell it. For example, in parts of Uttaranchal, tomatoes are dumped in February, the end of the season. Technology can help connecting farmers with buyers who

may be able to pick up the crop from the farm under the circumstances for value addition. While the farmers may still get a low rate, it is better than having to dump it. Farmers may also add value to it to prevent its wastage. This may be identified for specific crops and regions, such as tomatoes across India. The crop wastage may also be avoided.

8.3.3. Long Term Action Points

a. Technology and Entrepreneurship

Post-harvest activities involving handling the produce, storage and logistics comprise the next critical stage of the food production chain. A significant portion of the harvest is lost to inadequate or absent storage facilities. Prioritising development of storage facilities and allied transport and communication networks through various agencies is critical.

The private sector – especially the food processing industry - can play a big role in developing this supply chain element. Indigenous technologies like evaporative coolers, HDPE storage bags, metal silos and containers can be employed to enhance shelf-life of perishables like fruits and vegetables. Low-carbon technologies can be explored for development of efficient cold-chain systems. Skill development in handling and sorting can also lead to significant reduction in food loss.

In India, there is considerable scope for development of food processing and packaging industry to take up market slack, balancing the supply and demand inconsistencies. However, the food processing sector accounts for a significant share of food loss and waste due to heavy mechanisation and requirements of standardisation. This can be addressed through the following:

- Here, there is a need to re-engineer the production processes to enhance efficiency and creating nets to catch process rejects.
- Stricter legislation can play an effective role in monitoring and control of various processes aimed at reducing, recycling and reuse.
- Suitable incentives and economic ‘nudges’ can be created to improve processing, packaging, labelling to keep food usable for longer and optimize package/portion sizes.

Therefore, there are a large number of opportunities for the management of food and to reduce wastage.

8.4. Revitalizing Traditional Skills

This refers to such skills that reduce waste by deploying skills that extend the life of a product. Examples include cobblers, darners (traditional rafoogars), knife sharpeners, electronic repair walas etc. These skills are essential to shifting from linear to a circular economy, and to anchor the idea of resource efficiency in an Indian context. Revitalizing these will not only result in livelihoods, but also, help meet SDG goals. Governments at the national, state and local levels promote such revitalisation of traditional jobs as a part of the waste management ecosystem.

8.4.1. Short term action points

a. Include them as part of Swachh Bharat Mission and other schemes

- The sector must be mapped in every ward, across their various roles. Each one must be registered and given an I card, which entitles them to social security (such as ration, pension, accident and life insurance, and quality health care)
- Set standards for their occupational safety and work environment. They may be trained to improve digital savviness and be able to undertake basic accounting as required for a micro-enterprise
- Include these professions as part of micro-enterprises, so relevant ministries are able to help them
- Recognize them as essential for circularizing the economy.

b. Influencing Behaviour

- A massive awareness campaign is required to cajole and convince the public to use this sector's services.

- A campaign in needed on local and indigenous ways of reducing waste so that people can explore their own local resources.
- Awareness is also required for actors providing the services, to enable them access the services available for their benefit and to create their own market linkages.

8.4.2. Medium term action points

a. Policy Action

Allocate formal space

Most actors either use public land (roadside cobblers) or rent land (repair shops) for their work. Cities and districts should be required to incorporate such actors at the ward or other levels as part of zonal plans in ways that they are able to be seen by clients and potential clients.

Procurement by government

Government's own procurement policies should include procuring goods that can be repaired or made locally in the circular economy. A case in point is quilts with cotton wool instead of synthetic 'polyfill' for rest houses. These can be repaired or upgraded by service providers per the new norms. In each district, a short-listed number of such service providers may be identified with rates for all such jobs. This formalizes and encourages the use of these services. Market access for mapped goods that reduce waste in their production or other parts of their life-cycle, or upcycled products, has to be inbuilt in the relevant schemes as well as all procurement, from gifting to usage in offices.

The Right to Repair (RtR)

RtR is a cornerstone for consumption globally ahead. India already has such an ecosystem. Hence, RtR must be made part of any policy on resource efficiency, livelihoods and urban waste management. Some aspects of this should be identification, inclusion and upgradation of the actors, access to market and credit and skilling and recognition as micro-entrepreneurs.

Enhance access to credit

Many of these persons are unable to take small loans to upgrade their work and equipment, essential to their earnings. A policy enabling access to credit as well as subsidies on equipment required by them will foster entrepreneurship.

b. Technology and Entrepreneurship

- Map the range of actors and identify their perceived and other technological gaps. In some cases, technology can also be used for market access, such as in the case of service aggregators. Some of the technologies used are excellent examples of low-tech, high value. These include the cycle-pedal case of knife sharpeners. Some, like the cobblers, might need ergonomic interventions.
- The service providers require skill training to transition into formal sector entrepreneurs and take advantage of several existing schemes, including loans etc. This should be provided to them in a format that is easy for them, including the number of days, timings, content and post-skilling hand-holding.
- Aggregating such persons at a city-wide level is key, for easy access

8.4.3. Create a Market

a. Influencing Public Action

Influence the public to recognize their value and use their services as a key way to encourage the public to begin to use them. This must be in the form of campaigns, mentions by influencers and stories about their work in the media. The ULBs should be part of showcasing them in wards.

b. Access to markets

Access to market is a particular need for the service providers in the informal sector. While many of their skills are hard for consumers to come by due to the shifting nature of cities and gated communities, these skills are even more relevant than ever before. Access in this case can include

- linkages with service aggregators,
- promotion by state governments,

- inclusion in on-line directories and
- enabling them to work in spaces that are accessible and visible to potential customers.

In conclusion, this report identified short, medium and long terms action points for 4 sectors, in order to reduce waste. While these will be undertaken by various ministries, a centralized cell within the SBM should be formulated to ensure that these activities are coordinated and guided by the best knowledge. Waste reduction, resource efficiency and re-circulating materials remains the only way ahead for India.

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About the Contributors

1. Bharati Chaturvedi: Founder and Director of Chintan Environmental Research and Action Group
2. Chitra Mukherjee: Head, Advocacy and Policy at Chintan Environmental Research and Action Group
3. Dr. Vivek Agarwal Chairman WGCTT, International Solid Waste Association Chairman, Institute of Chartered Waste Managers
4. Dr. Vidhu K. Mathur, Senior Consultant, Professor, ICFAI University, Jaipur
5. Malati Gadgil- Sustainability Strategist, HP
6. Kripa Ramachandran- Circular Economy / Solid Waste Management Specialist (Consultant) at Asian Development Bank (ADB)
7. Tanvi Bhikchandani: Stanford University, Co-Founder of Tamarind Chutney, Sustainable and Fair Clothing Start-up
8. Charanya Shekar: Co-Founder of Tamarind Chutney, Sustainable and Fair Clothing Start-up
9. Amola Mehta: Student, Ashoka University

ANNEXURES

Annexure 1: Summary of Cases in NGT on Plastics

2017

1. **Yogindra Mohan Sengupta &Ors Vs. Union of India &Ors. (16.11.2017):**[21]

Initiated on: 30.5.2014 (earliest found)

Disposed off on: 16.11.2017

Years in court: 3 years, 10.5 months

Judges: J. Swatanter Kumar, J. Raghuvendra S. Rathore

Experts: Mr. Bikram Singh Sajwan, Dr. Nagin Nanda

Region Concerned: Shimla, Himachal Pradesh

Area: Principal Bench, New Delhi

Application no: O.A. 121/2014 and O.A. 505/2015 (Sheela Malhotra Vs. State of Himachal Pradesh &Ors.)

Status: Disposed of, no costs.

Issue: Plastic bag ban

Order:

This case concerned the inadequate disposal mechanisms for waste, disaster risk analysis, environmental quality and the environmental and health harms faced in the state. The Tribunal reaffirmed the ban on these of plastic bags and plastic packaging in the Shimla planning area. It stated that all state authorities must ensure that no plastic bags/plastic packaging are used, stored, sold or given with any product by the shopkeepers in the Shimla Planning area.

[21] http://www.shimlamc.org/file.axd?file=2017%2F11%2FNGT+Orders+-+FINAL_YOGINDRA+MOHAN+SENGUPTA.pdf

No other relevant mention of plastics

2. **M.S. Thankappan and Ors. Vs. Union of India Ministry of Environment and Forests, Forest Conservation Division Government of India, New Delhi and Ors. (15.11.2017):**[22]

Initiated on: 10.3.2017 (earliest found)

Disposed off on: 15.11.2017

Years in court: 8 months

Region Concerned: Periyar, Kerala

Area: Southern Zonal Bench, Chennai

Application no: 89 and 212/2014

Status: Disposed of, no costs.

Issue: Danger of plastic waste to wildlife.

Facts:

An application was filed against the development of a car park inside the Periyar Wildlife Sanctuary without obtaining Forest Clearance from the Centrally Empowered Committee. After obtaining approval from the National Tiger Conservation Authority for a Tiger Conservation plan, the Department of tourism began developing the area and making constructions under the guise of tiger protection.

The application was made to direct the respondents not to take up developmental/construction activities, and to recover damages and restore ecology. In this case, the applicant highlighted instances of wild animals consuming plastic waste and dying when such was thrown by tourists with leftover food.

[22] http://document.manupatra.com/Tribunals%20and%20Commissions/NATIONAL%20GREEN%20TRIBUNAL/2001-2012/ngt2017/GT201708121716031160.htm. Offline document available.

The Tiger conservation programme mentions that plastic wastes will be recycled. The vehicle parking site had become a threat to the wildlife due to damage to the vegetation, disposal of solid waste or plastic waste and noise pollution.

No other relevant mention of plastics.

3. Khalid Ashraf & Ors. Vs. Union of India & Ors. (11.7.2017):[23]

Initiated on: 6.9.2016 (earliest found)

Disposed off on: 11.7.2017

Years in court: Almost 1 year

Region Concerned: UP and all other States and UTs in India

Area: Principal Bench, New Delhi

Application no: O.A. 384, 442/2016 and M/A. 1247/2016 and 317/2017

Status: Disposed off, no costs.

Issue: Ban on synthetic manjha.

Facts:

Both applications here concerned synthetic, glass coated and Chinese manjha for kite flying, which is injurious and harmful to humans, birds and the environment (as it isnon-biodegradable). Even after being banned in various places, the sale of the manjhacontinued. Many HCs had directed that threads made of plastic/any synthetic should not be used for kite flying. The applicants contended that nylon/synthetic manjha, made of monofilament fishing line consists of a single plastic fibre and is glass coated. They highlighted the dangers posed by these lines and their breakdown (effects of micro-plastics on soil and water) to the environment, birds and animals, and swimmers. Its industrial manufacturing makes it almost impossible to break.

Order:

All state governments were impleaded as respondents and asked to submit reports on the steps they had taken towards a complete ban on synthetic thread (nylon, plastic, metal coating, etc., manjha). The Tribunal noted that at all levels, stringent measures had been initiated to curb the damage caused by nylon plastic strings, also appreciating that most have rightly differentiated between the cotton manjha and Chinese/artificial strings.

[23] http://document.manupatra.com/Tribunals%20and%20Commissions/NATIONAL%20GREEN%20TRIBUNAL/2001-2012/ngt2017/GT20172507171716461 36.htm. Offline document available.

With the help of reports from CPCB and CIPET, the Tribunal determined that many strings marketed as biodegradable were in fact non-biodegradable. It directed that there a total ban on manjha made of nylon/synthetic material/coated with synthetic substance would be imposed and that state governments would prohibit manufacture, sale, storage, etc., of the same. Import of such manjha would also be banned.

4. **Madhumangal Shukla Vs. Union of India and Ors. (3.7.2017):**[24]

Initiated on: 3.7.2017

Disposed off on: 3.7.2017

Years in court: --

Region Concerned: Vrindavan, Uttar Pradesh

Area: Principal Bench, New Delhi

Application no: 6/2017

Status: Disposed off, no costs.

Issue: Illegal dumping and non-compliance with MSW Rules.

Facts:

An application was filed against improper and unregulated disposal of MSW in Vrindavan, with continuous violations (of EPA, Water and Air Acts, and the MSW Rules) alleged. The applicant had submitted that the river Yamuna was greatly suffering due to dumping on its floodplain, and the potential sale of a landfill site. It had stated that there was no recycling unit/incinerator or official satellite dumping station in Vrindavan, and no action by the authorities had been taken. In an order dated 11.5.2016, the Tribunal had issued directions to tackle the breach of MSW Rules -

- It imposed environmental compensation of INR 5 lakh each on the Deputy Commissioner of Vrindavan and on the Nagar Palika Parishad, Vrindavan, as well as Environmental compensation of INR 1 lakh on the UPPCB, and INR 50,000 on the state/district administration
- A departmental enquiry was to be held on the development of the dumping site within 4 weeks, with submission of a compliance report.
- It also prohibited the use of carry bags and other plastic waste in Vrindavan, and demanded compliance with the state's prohibitory order.

However, the present application contended that the authorities had still not taken action, with unsegregated waste being dumped and burned and carry bags and plastic still being used.

[24] http://document.manupatra.com/Tribunals%20and%20Commissions/NATIONAL%20GREEN%20TRIBUNAL/2001-2012/NGT2017/GT201712071715580841.htm. Offline document available.

Order:

The Tribunal then ordered that costs be deposited within 2 weeks, that disposal according to MSW Rules start within 4 weeks, and that the district administration and Pollution Control Board ensure complete prohibition of plastic carry bags and waste. On failure to do so, the Executive Officer of Nagar Palika Parishad and District Magistrate, Mathura would be held personally liable.

5. **Social Action for Forest and Environment (SAFE) Vs. Union of India and Ors. (2.3.2017):**[25]

Initiated on: 31.3.2015

Disposed off on: 10.12.2015

Years in court: 8.5 months

Area: Principal Bench, New Delhi

Application no: 87/2015

Status: Disposed of, no costs.

Issue: Environmental harm caused by tourism

Facts:

In this case, the applicant prayed that the Tribunal direct closure and removal of camps along the River Ganga from Shivpuri to Rishikesh as they were causing environmental and water pollution. It also sought a regular policy for regulating recreational tourism.

Order:

The Tribunal directed, among other things, a complete ban on use of any plastic in the entire area, that camp operators separate biodegradable and non-biodegradable wastes before disposal.

[25] http://www.indiaenvironmentportal.org.in/files/beach%20camps%20Rishikesh%20river%20Ganga%20NGT%20Order.pdf

6. K.K. Plastic Waste Management Pvt Ltd Vs State of Karnataka &Ors (13.1.2017):[26]

Initiated on: Separate applications, sometime in 2016

Disposed off on: 13.1.2017

Years in court: Within 1 year

Region Concerned: Bengaluru, Karnataka

Area: Southern Zonal Bench, Chennai.

Application no: 110/2016, Appeal no. 117-119, 125, 128-130/2016 (Diary 542/2016).

Status: Dismissed, no costs.

Facts:

This case grouped plastic manufacturers, various traders and a cinema in Bengaluru in an application against the State of Karnataka. They filed an appeal seeking injunction against banning of plastics used by other parties after notification issued by the Government of Karnataka on 11.3.2016 under S. 5, EP Act. Their arguments included the environmental-friendly nature of plastic, its 'green category', loss of livelihood of workers (violation of Art. 14, 19, 21, 301-304), inapplicability of the plastic ban to flex materials, harmless manufacture of raw materials, various advantages of plastic bags, etc. They also argued that:

- A blanket ban on manufacturing activity constituted abuse of discretion and delegated power,
- No reasoned scientific study and environmental impact study had been undertaken before issuing the notification,
- Notification procedure hadn't been followed
- It wasn't a reasonable restriction on fundamental rights

The Karnataka Government replied that most of the substantial issues had been covered in *Goodwill Plastics* and *Karuna Society*. It highlighted the high levels of toxic plastic waste in Karnataka due to increase in manufacture, and also noted the hazards of plastics.

[26] https://plasticfreedelhi.files.wordpress.com/2017/05/related-judgement.pdf

It was decided that it was impossible to ban bags of less than 40 microns without banning plastic bags because the same technology was used to manufacture all, and it was hard to identify the former. After due consideration of all relevant factors, the government issued notification to restrict quantum of plastic generated and limit its use, where such was unwarranted and excessive.

As pollution due to plastic couldn't be tackled merely at the solid waste management level, but also needed to be addressed at the consumption stage, the state government issued the notification, and invited objections within 30 days. It also constituted an Expert Committee, which opined that:
- plastic used for packaging milk be exempted,
- the state government could encourage manufacture of alternatives with cheaper loans and subsidies

The state government argued that the ban was only for those plastic products that were excessively used inspite of existence of alternative products, and where such use was dangerous and non-biodegradable. The ban was implemented only after the PWM Rules were found insufficient. Public interest was seen as greater than economic interests, and furthermore, Karnataka wasn't the only state that had banned plastics. The government relied on the precautionary principle, sustainable development, and principles of intergenerational equity (in light of Directive Principles - Art 48A and 51(g), and Art 21). Plastics that were permitted were: those manufactured for export in SEZs, those forming an integral part of packaging, used in nurseries and milk packaging. CIPET agreed that while plastic was a material choice for a variety of products, the real issue was the collection, and the enormous quantity of waste available for recycling doesn't make it economically viable. Complete ban was against public policy.

The appellant argued that the impugned order was liable to be set aside on grounds of excessive delegation; inability of the state in making regulatory efforts couldn't be a ground for putting an end to any business activity against public interest. Arbitrariness violated Art. 14, 19(1)(g), 21, 301-304, challenging administrative action taken and the twin test of reasonable nexus and intelligible differentia (touch stone of Art 14). Counsel for appellant argued that Goodwill Plastics judgment couldn't create a precedent as:

- the Tribunal wasn't a Court of Record,

- the decision of an NGT Bench wasn't binding on another, and
- as the case discussed different substantial issues regarding the notification issued.

It was argued that the period of limitation started only after individual notification to manufacturers as under S. 16.

The applicants contended that flex was recyclable and that plastic content in flex was negligible, especially given the small size of the signage industry, and that there was an effective control mechanism for indiscriminate use of flex (including EPR).

Order:

3 issues were highlighted by the Tribunal:

- whether the appeals were maintainable in light of the decision in *Goodwill Plastic Industries* judgment
- whether the procedure for passing directions under S.5, EPA and the Rules was violated, and whether that vitiated the notification, and
- whether appellants were entitled to other reliefs

The Tribunal stated that *'A combined reading of these two powers makes it clear that the power given to the Central Government under Sections 3 and 6 read with Section 25 of the EP Act is statutory rule making power, while the power given under Section 5 of the EP Act to the Central Government is to exercise its executive power. While the statutory legislative power conferred to the Central Government under Sections 3 and 6 read with Section 25 of the EP Act cannot be delegated, the power conferred to the Central Government under Section 5 of the EP Act can be delegated by virtue of the power under Section 23 of the EP Act.'*

Except rule making power of the Central Government (including the power to constitute an authority under S.3(3)), all other powers can be delegated. Rules framed under S.3 and S. 6, read with S. 25, shall also be placed before both Houses of Parliament for a total period of 30 days; after (if) any modification is required, Rules shall have effect under S. 26. These then have parliamentary sanction.

The Tribunal then referred to a notification dated 10.2.1988, in which the Central Government had delegated its powers to the state governments under S. 23. Thus, the Karnataka Government enjoys power of the Central Government under S. 5. It noted the difference in nature and extent between legislative rule-making power and administrative power, and then proceeded to discuss how the Plastic Rules 2011 had been superseded by the Government of India by framing the PWM Rules 2016.

The Tribunal stated that it is only the exact power of the Central Government to issue direction under S. 5 of the EPA that can be exercised by the delegated authority, including the state government. Such power is subject to the provisions of the EPA, regardless of which body is exercising its power (this being the only condition - that this power not be contrary to the provisions). '*It doesn't mean that the power to issue direction under S. 5 shouldn't be relating to any measure taken by statutory rules under S. 3,6, read with S. 25. Here, S.5 read with S.23 allows state governments to issue directions only in respect of their territorial jurisdiction.'*

The Tribunal noted that both these types of powers weren't inconsistent with each other, and that one couldn't state that merely by issuing a direction under S. 5 there resulted a violation of rule-making power under S. 3,6, read with S. 25 (as laid down in *Goodwill Plastic*, where the UT of Chandigarh exercised its power under S. 5 to issue a notification. The Tribunal had held that the 2011 Rules were intended to not only act as a regulatory measure but to also protect the environment - thus the ban operated in distinct and different fields, with no conflict.) '*While some sections such as S. 9 were required to be complied with to carry on business (as regulation), S. 5 was primarily mandatory, and intended not only to act as a regulatory measure but also as preventive and prohibitory measure. The provisions here are in exercise of extraordinary powers vested in the Central Government, primarily intended to meet emergencies of the environment - to protect the environment and ensure that degradation doesn't take place. Wherever environmental pollution occurs, directions to the extent of closure and prohibition are issued under S. 5. Thus both these powers reinforce principal object of protection and improvement of the environment.'*\

The Tribunal noted that a draft notification had been issued by the state government, intending to give direction under S. 5 and calling for objections. It also indicated that plastics harmed the health

of living beings and the environment. The Tribunal noted that all appellants were aware of the draft notification and had made detailed objections. It referred to Rule 4 of the EP Rules, where the procedure for giving directions under S. 5 was detailed. It stated that though the purpose of powers given under S. 5 is executive in nature, it is mandatory for the purpose of providing a clean environment.

It noted that as the purpose of giving notice in writing was to see that the affected parties were informed and had a reasonable opportunity to raise their objections, *principle of natural justice had not been violated by the procedure followed by the Government of Karnataka* (it discussed the theory of useless or empty formality as a rare exception to the rule of Audi alter am partum).

As the powers under S. 5 are executive in nature, the Rule is well settled that the executive authority needn't give elaborate reasons like a Judicial/Quasi-judicial authority. It concluded that if the state *government has taken a stand to ban, due to the reason of its inability to control and regulate such large-scale usage of plastic materials, such a decision is legal and has been taken with application of mind.* Directions issued under S.5 need not be just in respect of individual cases, but can also take note of the very object of issuing such directions and apply to the particular nature of an industry. Impossibility of enforcing regulations efficiently can be a ground for invoking S.5 in larger public interest. The state had applied its mind and given reasons, and it was not for the Tribunal to decide on the correctness of the reasons, unless they were perverse and totally illegal.

It held that there had been no violation of procedure under Rule 4.

'The power of delegation to the Pollution Control Board/Committee is relating to the power of the Central Government in issuing directions to individual industries or local or any other authority. However, power of delegation to the stated governments can be applied in respect of the similarly situated industries at large, and isn't restricted to individual industries/local/any other authority (like the Central Government).' Thus, the Tribunal noted that delegated powers of PCBs are different from those of the state governments under S.5.

It held that the notification presented a reasonable restriction to Art. 19(1) (g) - not all plastic products were banned, only those incapable of being managed and creating a menace to the environment. The Tribunal noted that it wasn't its place to find fault with the Experts' Report, which stated that maintenance and regulation of plastic waste was impossible at this scale. The Tribunal acknowledged that it could always take judicial notice of indiscriminate use of such materials in public interest. It discussed the harms of plastic, the right to life guaranteed in the Constitution (which includes hygienic, clean, safe environment). It finally noted that as the appellant had given categorical assurance that all flex materials would be recycled, it was for the state government to consider whether flex can be exempted. Till the state government passed orders on such, flex materials would continue to be covered under the ban.

The application and appeals failed and were dismissed, without costs.

2016

1. **Sangli Zilha Sudhar Samiti Vs. The Commissioner, Sangli Miraj and Kupwad Municipal Corporation and Ors. (29.12.2016):**[27]

Initiated on: 12.8.2014

Disposed on: 29.12.2016

Years in court: 2 years, 4 months

Region Concerned: Sangli-Miraj-Kupwad, Maharashtra

Area: Western Zonal Bench, Pune

Application no: 115/2014.

Status: Disposed off

Issue: Non-compliance with the 2011 Rules

Facts:

An application was filed under Ss. 14 and 15 read with S. 18(1) of the NGT Act to address unscientific dumping of garbage and solid waste, including plastic waste, by the Kupwad Municipal Corporation, which had led to environmental degradation. The applicant prayed for directions regarding compliance with the Rules, and also that strong legal action is taken against businessmen and users of banned plastic bags, emphasising the importance of segregation at source. It prayed that:

- the authorities be asked to submit a report with the number of persons/industries engaged in illegal plastic bag business/manufacturing, and how many legal actions (and of what kind) had been taken against various business establishments for use of banned bags
- The 2011 Rules be strictly enforced
- Directions be given to set up systems for use of plastic waste in road construction and/or in co-incineration plans for generation of energy, and
- Directions be issued against unregulated open burning of plastic/rubber.

[27]Offline document available.

Order:

The Tribunal appointed a high level project monitoring Committee to ensure time-bound execution and compliance. It directed the MPCB to conduct regular inspection of existing waste disposal sites at least once a month, to ensure SWM Rules are adhered to strictly, with no open burning (compensation cost of minimum INR 5000 for those who violated this rule), to keep a record of any fires and report such to the Monitoring Committee.

2. Almitra H. Patel And Ors. Vs. Union of India And Ors. (22.12.2016):[28]

Initiated on: 2.12.2014

Disposed on: Last found - 27.10.2017

Years in court: Almost 3 years

Region Concerned: Bengaluru, Delhi + other states/cities in India

Area: Principal Bench, New Delhi.

Application no: O.A. 199/2014.

Status: Disposed off, no costs.

Issue: Lack of system for waste management, and later, lack of proper compliance by all states of UOI with MSW Rules.

Facts:

The petitioner filed a PIL under Art. 32 in the Supreme Court in 1996 regarding the lack of national enforcement of waste management rules in all states, citing examples of illegal dumping and harmful consequences of such. She stated that the state governments had failed to discharge their constitutional and statutory obligation under S. 5 of the EPA, and that the CPCB had failed to frame guidelines and recommendations for management of MSW guidelines framed haven't been followed/implemented, and the Boards haven't taken steps to ensure proper implementation, and thus have failed to perform their statutory duties.

The applicant listed household waste, city waste, commercial waste, human excreta, industrial waste and hazardous waste, and listed deficiencies in dealing with MSW in cities, including the lack of well managed sanitary landfills. She pointed to the revenue potential of privatised waste management. *Municipal Council, Ratlam Vs. Vardhichand* was highlighted, where the Supreme Court held in 1980 that municipalities could not plead a lack of funds, where Art. 21 was concerned. She prayed for reliefs including budgetary provision for development of long-term waste-yards for

[28]Offline copy available.https://indiankanoon.org/doc/339109/

Class-I cities, linking of penal interest for non-payment of property taxes, issuance of proper directions under S. 5

She mentioned that animals consume wastes including plastic waste, and prayed for introduction of legislation to regulate/ban or impose punitive taxes on excessive packaging and the use of non-recyclable packaging like Styrofoam, foil coated plastic, plastic-coated paper.

In the subsequent years, this writ was transferred from the Supreme Court to the Principal Bench, NGT, and MSW and Plastic Rules were notified. The Tribunal noted that better enforcement was needed by all States, as all had been impleaded as respondents.

Order:

The Tribunal noted that Rule 21 did contemplate that plastic and non-recyclable waste, which has high calorific value, would be used directly for power generation and/or through RDF.

In *Kudrat Sandhu Vs. Govt. of NCT of Delhi and Ors*, the Tribunal had directed that the use of disposable plastic glasses was prohibited in entire NCT, at hotels, restaurants and public and private functions. It ordered that the NCT take appropriate steps against storage, sale, use of such plastic material at above places, and it would be prohibited w.e.f. 1.1.2017.

The Tribunal noted that while Clause (i) of Schedule-1 of the 1986 Act limited utilisation of inert and non-biodegradable waste in building roads, this applied only to the hills. The Act didn’t provide for why such waste and particularly non-recyclable plastic shouldn't be used for actual construction of roads in all parts of the country, which it noted as an advantage and convenience that the 2016 Rules didn't acknowledge.

The applicant had sought a ban on short life PVC and chlorinated plastics, and directions to SPCBs to encourage supply of combustibles including mixed plastics as RDF to nearby industries, power plants and cement plants. The CPCB concurred with this suggestion, and the MoEF said that it was open to such consideration, but only after necessary examination by a group of experts. The MoEF

also noted that the Bio-Medical Waste Rules 2016 also stipulated phasing out the use of chlorinated plastic bags within 2 years.

The Tribunal here issued directions including:

'14. The non-biodegradable waste and non-recyclable plastic should be segregated from the landfill sites and be used for construction of roads and embankments in all road projects all over the country. To this effect, there should be a specific stipulation in the contract awarding work to concessionaire/operator of the facility.'

The Tribunal also directed the MoEF and state governments to consider and pass appropriate directions to '*ban short life PVC and chlorinated plastics as expeditiously as possible, not later than 6 months from date of pronouncement of judgment.'*

The applications were disposed of, without cost.

3. Bidyut Mohanty Vs. District Collector, Koraput and Ors. (21.12.2016):[29]

Initiated on: 31.8.2015

Disposed on: 21.12.2016

Years in court: 1 year, 3 months

Region Concerned: Koraput, Odisha

Area: Eastern Zone Bench, Kolkata

Application no: 78/2015

Status: Disposed off, no costs.

Issue: Non-compliance with MSW Rules, and determination of a plastic free zone.

Facts:

An application was filed invoking S.18(1) read with S. 14(1) of the NGT Act, praying for a direction to the state authorities to enforce the 2011 Rules in the Gupteswar Temple area, Koraput, Odisha, and issue a notification declaring the area as a 'Plastic-Free Zone'. He claimed that there was rampant and unrestricted use of polythene carry bags, coloured recycled carry bags, plastic disposable caps, plastic plates, polythene water pouches, sachets etc., with an average generation of 4 metric tonnes of garbage everyday being dumped in the Gupteswar Reserve Forest and the Saveri river.

The PCB stated that its role is limited to the grant and renewal of registration for plastic manufacturing units, grant/refusal of consent for such units under Water/Air Acts, and submission of annual report to the CPCB under Rules 9 and 12 of the 2011 Rules. Enforcement of provisions of 2011 Rules relating to use, collection, segregation, transportation and disposal of plastic wastes was to be done by the municipal authority. The State Level Advisory Body, constituted according to a notification by the Forest and Environment Department, Government of Odisha, had directed that:

[29]Offline document available.

- Mass awareness shall be created regarding menace of plastic wastes, and training programmes, seminars, etc., may be taken up to discourage use of plastic carry bags.

- The list of plastic manufacturers and recycling units registered with MSME department shall be collected and consent status shall be verified.

- Under the EPA, violation of the 2011 Rules attracted penal provisions and officers are authorised to take cognizance of offences and file prosecutions in Courts, under S. 19, EPA.

- Municipal Corporations shall identify/set up plastic waste collection centres in their jurisdiction.

- Rag pickers may be incentivised in providing plastic waste at collection centres set up by municipalities.

- Segregation of plastic wastes may be attempted at household level, hoardings may be placed to keep city free from plastic wastes.

- Forest and Environment Dept shall provide experts for training in field of Plastic Waste Management.

Order:

The Tribunal noted that the plastic waste was a threat to the flora, fauna and river ecology, and the demands of the Durua tribal community to make the area 'plastic-free'. It noted that the Gram Panchayat was the appropriate authority under the 2016 Rules for implementation of these Rules, and referred to Rule 12 (prescribed authority) and Rule 7 (responsibility of the Gram Panchayat).

The State had suggested declaring the area a plastic-free zone, along with imposition of INR 1000 for first time offenders and INR 2000 for subsequent violations. The Tribunal highlighted text from the judgment in Krishan Kant Singh Vs. M/s. Triveni Engg. Industries Limited (O.A. No. 317 of 2014), which discussed the precautionary principle. It directed the SPCB, the statutory authority in charge of implementing Water/Air Acts and EPA, to take steps towards prohibition of plastic carry bags in the area, and ensure monitoring of implementation of the Rules.

4. Bolpur Station Road Bvabsayee Welfare Samity and Ors. Vs. Subhas Datta and Ors. (20.12.2016)[30]

AND

Subhas Datta Vs. Visva Bharati University and Ors. (1.11.2017):[31]

Initiated on: 7.12.2016

Disposed on: 1.11.2017

Years in court: 11 months

Region Concerned: Bolpur, West Bengal

Area: Eastern Zonal Bench, Kolkata

Application no: M.A. 1265/2016 in O.A. 16/2016; O.A. 16/2016

Status: Disposed off, no costs.

Issue: Non-compliance with MSW Rules, bad management of plastic waste during Poush Mela.

Facts:

This application had been filed to recall/modify previous orders in order to prevent deprivation of opportunity to set up stalls during the Poush Mela, adversely affecting the applicant's business interest. It was contended that the previous orders had been obtained on incomplete information, with only a few aspects of environmental pollution being highlighted. It was alleged that restricting the Poush Mela to 3 days and prohibiting bursting of firecrackers, by the orders, is contrary to the spirit and tradition of Poush Mela. The applicant contended that the directions were in excess of jurisdiction, as per S. 20 of the NGT Act, and affected commercial interests and rights under Art. 21 and 19(1)(g). He claimed that jurisdiction to issue directions about the Poush Mela lay with the Santiniketan Trust. The applicant asserted that after the 4th day, there would be steps taken towards garbage disposal and anti-pollution measures on the University campus.

The applicant contended that strangers had hijacked the event with indiscriminate use of thermocol and plastic materials. The Tribunal noted that the foundational cause for the case was the immense

[30]Offline document available.
[31]Offline document available.

pollution caused during the Poush mela, where the SPM level had shot up 10 times over the safe limit.Though the university area was a plastic-free zone, there no check/control in use of plastic/thermocol products during the event, and so solid and plastic wastes had been found dumped all over. There was no subsequent solid waste management, and waste was left scattered for many days; waste had even been found burnt and thus, polluting the atmosphere. It noted that the MSW Rules and guidelines issued by the Environment Department for holding fairs had been flouted brazenly.

The Tribunal noted that the main issue was lack of disposal mechanism.

Order:

Though the university wasn't within the jurisdiction of Bolpur Municipality, it issued a direction to the State to consider how to enable the municipality to undertake collection and disposal of waste from the university. The State immediately took the necessary steps. The Tribunal found that the university hadn't obtained authorisation from the Board for setting up waste treatment process and disposal facility in compliance with the MSW and Plastic Rules. It directed the Municipal Corporation to take the required steps to enforce compliance and plan a good disposal mechanism including the University. It also directed that the organisers of the festival monitor *'the use of plastic and other non-biodegradable substances during the Mela. Ideally, the use of plastic and thermocol products ought to be strictly prohibited and, in the interest of the environment and to enable the local villagers to derive some economic benefit, use of leaf containers and plates and wood based spoons should be encouraged.'*

5. Wonderseal Packaging Vs. The Member Secretary, Maharashtra Pollution Control Board and Ors. (19.12.2016):[32]

Initiated on: 19.12.2016

Disposed on: 19.12.2016

Years in court: --

Region Concerned: Maharashtra

Area: Western Zonal Bench, Pune

Appeal no: 76/2016

Status: Disposed off, no costs.

Issue: Whether authorities can exercise power under S. 33A of the Water Act and S. 31A of the Air Act to stop running of an industry when the alleged violation is of provisions under the 2016 Plastic Rules.

Whether authority has power under S. 5 of the EPA to issue order/directions.

Facts:

The Tribunal had passed an order against the appellant, Wonderseal Packaging Industry, which manufactured plastic bags, to cease functioning, under S. 33A of the Water Act, and S. 31A of the Air Act. The appellant invoked S.16(c) and (g) of the NGT Act, and contended that plastic bag manufacture was under the 'Green' category, and it hadn't violated any provisions related to manufacture, sale and storage of plastic bags. The appellant admitted that it had violated consent and required permissions, but not any provisions of the Air and Water Acts.

Order:

The Tribunal clarified that the S. 33A of Water Act and S. 31A of the Air Act confer powers on PCBs to close the industry and stop supply of electricity, etc. However, these powers can only be invoked by the Board in exercise of its powers and performance of its functions 'under this Act'. Thus complaints about violation of the 2016 Plastic Rules cannot be addressed under the Water/Air Act,

[32] http://document.manupatra.com/Tribunals%20and%20Commissions/NATIONAL%20GREEN%20TRIBUNAL/2001-2012/ngt2016/GT201611011715535247.htm. Offline document available.

unless the Board shows that it thought this suitable in exercise of powers conferred by the respective Acts. These two provisions are penal in nature, with mandatory compliance. Though the counsel for the respondents claimed that S. 33A and 31A of Water/Air Act had been invoked because there was no specific provision to take such action under 2016 Plastic Rules, the Tribunal noted the powers given to authorities under S. 5, EPA, and that the Board hadn't provided an explanation as to why it couldn't invoke this provision.

It quashed the order, holding it illegal.

6. Mahesh Dubey Vs. Chhattisgarh Environment Conservation Board and Ors. (15.12.2016):[33]

Initiated on: 9.12.2014

Disposed on: 15.12.2016

Years in court: 2 years

Region Concerned: Chhattisgarh

Area: Principal Bench, New Delhi

Application no: M.A. 107/2016, in O.A. 507/2014

Status: Disposed off, no costs.

Issue: Plastic waste in bio-medical waste.

Facts:

An application was filed regarding improper disposal and serious mismanagement of bio-medical waste in Chhattisgarh. However, the Chhattisgarh Environment Board contended that there was at source segregation of biomedical waste by hospitals in colour-coded plastic carry bags, which were disposed of at earmarked sites by deep burial methodology. It was also stated that no rag pickers were allowed to collect plastic waste at the disposal site, and that plastic waste, syringe, intravenous sets, etc., were being treated chemically and disposed of after shredding, with no mixing of MSW being done. Under the Bio-Medical Rules 2016, there was a duty to phase out use of chlorinated plastic bags, gloves and blood bags within 2 years, and to give recyclables from treated bio-medical wastes such as plastics to authorised recyclers. Further, occupiers were required to phase out use of non-chlorinated plastic bags within 2 years, and after that chlorinated plastic bags were not to be used for storing/transporting bio-medical waste. Such plastics would not be disposed of by incineration, but be treated as per the 2011 Rules until Standards were published by the Bureau of Indian Standards.

Order:

[33] http://www.indiaenvironmentportal.org.in/files/bio%20medical%20waste%20Chhattisgarh%20NGT%20Judgement.pdf

The Tribunal noted that there was no compliance with rules and laws in Chhattisgarh, and that treatment of biomedical waste needed immediate attention. It ordered for the formation of a committee to prepare an inventory, a report and an action plan for implementation of the 2016 Rules.

7. Sarika and Ors. Vs. The State of Kerala and Ors. (13.12.2016):[34]

Initiated on: 13.12.2016

Disposed of on: 13.12.2016

Time in court: --

Judges: J. M.S. Nambiar

Experts: Mr. P.S. Rao

Region Concerned: Kayamkulam, Kerala

Area: Southern Zonal Bench, Chennai

Application no: 301/2013

Status: Disposed off, no costs.

Issue: Non-compliance with MSW Rules.

Facts:

An application was filed regarding dumping of organic and plastic wastes at a site in Kayamkulam Municipality, seeking directions to respondents to implement their MSW project in a scientific way. The land in question had been acquired for the purpose of constructing a modern and scientific waste treatment plant with windrow compost units, plastic shredding units, etc. The proposal to construct the plant had no mention of many details, including details of the plastic shredding machine proposed with type of plastics to be shredded and the modes of utilisation of the shredded plastic, etc.

Order:

The Tribunal ordered that Kayamkulam Municipality must comply with criteria for site selection and standards for solid waste processing, and then seek authorisation under the SWM Rules 2016 to operate the plant.

[34] http://document.manupatra.com/Tribunals%20and%20Commissions/NATIONAL%20GREEN%20TRIBUNAL/2001-2012/ngt2016/GT201623011716043489.htm. Offline document available.

8. Bimal Singh Karnawat and Ors. Vs. West Bengal Pollution Control Board and Ors. (21.9.2016):[35]

Initiated on: 21.9.2016

Disposed of on: 21.9.2016

Time in court:

Judges: J. Pratap Kumar Ray

Experts: Prof. (Dr.) P.C. Mishra

Region Concerned:

Area: Eastern Zone Bench, Kolkata

Application no: 80/2015

Status: Dismissed, no costs.

Issue: Reprocessing of plastics and industry categories

Facts:

An application was filed against a factory manufacturing plastic jars, due to heavy pollution caused by manufacturing HD and polymer products, which were emitting odour and fugitive toxic emissions like carbon monoxide, chlorine, hydrochloric acid, etc. It was also alleged that the waste from the factor wasn't being managed, leading to water pollution; that there was unauthorised disposal of plastic wastes, along with air pollution due to the release of micro plastic particles; and that the factory hadn't obtained the required environment clearance.

The plastic factory fell under the ordinary 'red' category of industry, under S. No. 19 of the list of industries - '*manufacturing and processing of PVC granules and manufacturing of processed PVC products*'. The unit owner pleaded that the unit used virgin granules for manufacturing plastic jars, and that extra plastic material was ground and re-used in the process, with no waste plastic being used for raw materials.

The PCB had carried out an inspection of the factory, and in the report they had mentioned that:

[35]Offline document available
http://www.indiaenvironmentportal.org.in/files/industry%20residential%20area%20NGT.pdf

- virgin plastic granules were indeed being used as *main* raw materials 'along with a certain percentage of trimmed materials of the product'
- no open burning or scraps or combustion/incineration of plastic was observed

The applicants submitted that 'trimmed materials' of product were waste plastic and not virgin granules and that 'production rejects', which weren't virgin granules, were being reused in the manufacturing process. Thus, it alleged that the unit was reprocessing waste plastic. Further, it demanded that the factory be delisted from the Green category and put in the Orange category, and that the report suggested the use of non-virgin/scrap/rejected/waste plastic as raw materials. The applicants argued that the unit fell within the Ordinary Red category (manufacturing and reprocessing of PVC granules and manufacturing of reprocessed PVC products); if not, it fell within Orange category (reprocessing of waste plastic, excluding PVC).

Order:

The Tribunal held that as Rule 3(m) of the 2011 Rules defined plastic waste as '*plastic product such as carry bags, pouches or multi-layered plastic pouch or sachet, etc. which have been discarded after use or after their intended life is over*', the 'rejected plastic material' used by the respondents wouldn't be covered under the Rule and wouldn’t be considered plastic waste. Here, it also referred to the PCB's report that stated that no use of plastic waste as raw material had been observed. The factory would remain in the Green category.

2015

1. **Tamil Nadu HDPE Knitted Fabrics Manufacturers Association Vs. The Secretary, Central Insecticides Board and Registration Committee, Ministry of Agriculture and Ors. (15.12.2015):**[36]

Initiated on: 15.12.2015

Disposed of on: 15.12.2015

Time in court: --

Judges: J. M. Chockalingam

Experts: Mr. P.S. Rao

Region Concerned: Karur, Tamil Nadu

Area: Southern Zonal Bench, Chennai

Application no: 273/2014

Status: Dismissed, no costs.

Issue: Consent to establish, misuse of hazardous plastic waste

Facts:

TN High-Density PolyEthylene Manufacturers Association, which works for the welfare of the knitted fabrics manufacturers by regulating them in accordance with law, filed an application alleging that certain industries were involved in the illegal sale of hazardous waste materials to the public by misusing the export quota. It sought that their licenses be revoked, as they had been manufacturing Long Lasting insecticide Impregnated Material (LLIN), using alpha-cypermethrin (highly toxic and hazardous), and illegally selling the net fabrics as waste. It contended that the authorities had stated that they were licensed, and that they had also said the material wasn't

[36] http://document.manupatra.com/Tribunals%20and%20Commissions/NATIONAL%20GREEN%20TRIBUNAL/2001-2012/NGT2015/GT201505011615412993.htm
Offline document available.

hazardous. The TNPCB (Tamil Nadu Pollution Control Board) had received complaints that these industries were selling net fabrics and solid waste (plastic lumps, filaments, net fabrics) to outsiders, which were then transformed into vessels for domestic use causing health hazards.

When a unit applied for consent to manufacture LLIN under Air and Water Acts, it was told to get the opinion of the Central Institute for Plastics Engineering and Technology. CIPET observed that the test results showed that it was safe to manufacture and use mosquito nets as a commodity item. These wastes were also tested to find out the concentration of alpha-cypermethrin in the leaching of the plastic waste, and the concentration was shown to be low. TNPCB declared that the plastic waste generated wasn't hazardous as per the Hazardous Waste Rules 2008, and that such manufacture was also approved by WHO. Consent to establish was issued to the manufacturers, with the condition that the unit shall dispose of non-hazardous solid wastes immediately without accumulating them inside the premise, which they complied with.

TNPCB carried out the test regarding concentration of alpha-cypermethrin in plastic waste to decide whether to accommodate the plastic waste containing the chemical in any of the following waste, listed in Class A of Schedule II of the Hazardous Waste Rules:
- A-16 (Halogenated compounds of aromatic rings
- A-17 (Halogenated aromatic compound)
- A-19 (Organo Chloride Pesticide)

The respondents (unit owners) were of the opinion that the best possible solution was plastic recycling, as every recycling stage thermally degrades the plastic, and insecticide further reduces the life of the plastic because degraded plastics decompose faster than virgin plastics.

Order:

The Tribunal found no merits in the application regarding misuse of any hazardous plastic waste, as the concentration levels were within legal limits.

2. Indian Council for Enviro-Legal Action & Ors. Vs. National Ganga River Basin Authority & Ors. (10.12.2015):[37]

Initiated on: 10.12.2015

Last heard on: 18.12.2015[38]

Time in court: 6 months

Judges: J. Swatanter Kumar, J. M.S. Nambiar

Experts: Prof. A.R. Yousuf, Mr. Bikram Singh Sajwan

Region Concerned: Haridwar and Rishikesh, Uttarakhand

Area: Principal Bench, New Delhi

Application no: O.A. 10/2015 and 200/2014

Status: Disposed off

Issue: Cleaning of River Ganga.

Facts:

The applications filed were the lead cases regarding the cleaning of River Ganga. Among other things, the Tribunal noted that MSW Rules were not being followed resulting in plastic wastes being thrown directly into the Ganga and on its banks. Further, there was open burning of garbage including plastic waste.

Order:

The Tribunal referred to the judgment in Indian *Council for Environment Legal Action Vs. Union of India &Ors.* stating that the prohibition of use of plastic in Haridwar around the Ghats must be expanded to the entire state due to the harms of plastic. It noted that other hill stations had banned plastic, which had helped prevent further environmental degradation. It also stated that public authorities must regulate activities of pilgrims, ensuring that no plastic in any form is used, except for collecting holy water in plastic cans.

[37] http://www.indiaenvironmentportal.org.in/files/dumping%20waste%20Haridwar%20NGT.pdf
[38] http://www.greentribunal.gov.in/Writereaddata/Downloads/200-2014(PB-I-Judg)OA_18-12-2015.pdf

The Tribunal directed that there shall be complete prohibition of use of plastic in the entire city of Haridwar and Rishikesh, particularly on the banks and flood plain of Ganga, and also banned use of plastic carry bags of any thickness. It said that plastics that could be used as fuel should be sent to proper plants, and imposed environmental compensation of Rs. 5000 per violation.

No other relevant mention of plastics.

3. Mansi Chahal Vs. Delhi Pollution Control Committee and Ors. (10.12.2015):[39]

Initiated on: 10.9.2015

Disposed of on: 10.12.2015

Time in court: 3 months

Judges: J. Swatanter Kumar, J. M.S. Nambiar

Experts: Dr. D.K. Agrawal, Prof. A.R. Yousuf

Region Concerned: New Seemapuri, Delhi

Area: Principal Bench, New Delhi

Application no: 399/2015

Status: Disposed off, no costs.

Issue: Illegal dumping by the corporation and non-compliance with the MSW Rules, 2000.

Facts:

The applicant had filed an application regarding a huge garbage dump on a road in New Seemapuri, due to which the entire residential area was affected. She contended that the EDMC's (East Delhi Municipal Corporation) van was also throwing garbage in the middle of the road regularly, and that this hadn't stopped despite protests from residents. She averred that plastic and polythene was also being burnt, and prayed that the authorities be directed to remove the garbage and take action against people who were dumping garbage.

Subsequently, the tribunal passed an order, noting indiscriminate dumping, with photos of burning plastic waste. It stated that the corporation had flouted MSW Rules, Tribunal Order and the EPA, and that one couldn't even make out the actual road because of the quantity of garbage being dumped.

It imposed environmental compensation of INR 50,000 on the EDMC, recoverable from the salaries of erring, negligent officers responsible. It directed that the EDMC Commissioner personally

[39] http://www.indiaenvironmentportal.org.in/files/solid%20waste%20Delhi.pdf

conduct an enquiry to fix responsibility and recover the amount. It issued notices to the PWD and Delhi Urban Shelter Improvement Board to show cause as to why environmental compensation shouldn't be imposed on them. The Tribunal also ordered a meeting of all Corporation Commissioners in Delhi, with preparation of a report on reasons for this dumping at various places in NCT, Delhi, along with the involvement of authorities from UP. It directed that all vehicles engaged and owned by the Corporation would be fitted with GPS, to ensure proper carriage of MSW to dumping sites.

Order:

In the present order, the Tribunal noted that the Corporation was completely malfunctioning and that garbage weighing 11,583 MT had been transported to the said site, as shown by documentation. It directed that:

- The Corporation completely comply with directions in the previous order, within 3 weeks, and submit a report of compliance
- The EDMC Commissioner provide clear guidelines regarding MSW Rules, and ensure that no garbage dumping occurs at the site (if no alternative, then use it as a temporary dumping site, with garbage lifted within 24 hrs of dumping)
- The Corporation fill up the low-lying area that was being used for dumping

4. G. Vijaya Kumar Vs. The Secretary to Government, Health and Family Welfare Department, Government of Tamil Nadu and Ors. (15.10.2015):[40]

Initiated on: 17.4.2015

Disposed of on: 15.10.2015

Time in court: 6 months

Judges: J. M. Chockalingam

Experts: Mr. P.S. Rao

Region Concerned: Tamil Nadu

Area: Southern Zonal Bench, Chennai

Application no: 117/2014

Status: Disposed off, no costs.

Issue:

- Whether Extended Producer Responsibility, under Rule 3(g) of the Plastic Rules, 2011, applies to producers of disposable sanitary napkins and diapers.
- Whether such producers can be directed to evolve sound waste management systems for these used products.

Facts:

An application was filed against manufacturers of disposable sanitary napkins and diapers to evolve a sound waste management system for safe collection of used disposable sanitary napkins and diapers from end users, and proper, scientific, eco-friendly disposal at the cost of the manufacturers. The applicant sought a direction to create a Revolving Fund to help screen sanitation and sewage workers across the country and for their rehabilitation. He highlighted the hazardous consequences of bad disposal (clogged drains, health hazards, air pollution from incineration, etc.), and stated that disposable napkins and diapers consist of plastics such as acrylic

[40]Offline document available.

based super absorbent polymers and come under the 2011 Plastic Rules. He stated that the manufacturers are duty bound by Extended Producer Responsibility (under the 2011 Rules) and must ensure development of a waste management system, as the materials used do not biodegrade at all and remain unchanged for hundreds of years. However, TNPCB stated that while manufacturers had a social responsibility to educate users about environmentally safe disposal, these used napkins and diapers couldn't be considered as plastic waste under the 2011 Rules, but were comparable with biodegradable medical waste under the Biomedical Waste Rules, 1998.

Order:

The Tribunal discussed Rule 3(g) of the 2011 Rules, which states: *'Extended producer responsibility (EPR) means the responsibility of a manufacturer of plastic carry bags, and multilayered plastic pouches and sachets and the brand owners using such carry bags and multilayered plastic pouches and sachets for the environmentally sound management of the product until the end of its life'*. Though the applicant claimed that the respondents' products were multi-layered and contained plastic, the respondents had admitted that they weren't manufacturing plastic carry bags/multi-layered plastic pouches and sachets, but only the napkins and diapers. The Tribunal noted that Rule 3(k) applied only to manufacturers of multi-layered plastics, and that the respondents weren't manufacturing any products found in Rule 3(g). Thus, it expressed its concern about whether the EPR rule could be applied to products of these respondents.

The Tribunal noted that the main problems were flushing out through the sewerage system into water bodies, incineration, deposition at landfills, which caused air and water pollution, and that these were due to age old practices followed by people. It stated that it couldn't understand how producers could be directed to evolve any waste management system for collection of used products and scientific disposal, apart from giving necessary warnings and instructions on their products for environmentally safe disposal (which they had already done at the time of sale). It cited Rule 6(c) of the 2011 Rules, which lays down the municipal authority's responsibility in setting up a plastic waste management system and performing associated functions. It noted that the authority was duty bound to ensure that no damage was caused to the environment during this process, and that health workers would have to be provided with proper protective apparatuses and screening under the Rules.

The only obligation of these product manufacturers could be under S. 6(d) - to financially contribute to the establishment of collection centres, if required by the municipal authorities. They are obliged to contribute financially ONLY IF their products fall under S. 3(g) - the EPR Rule. The Tribunal stated that such transfer of responsibility and duty to the respondents from the municipal authorities was misconceived. While it noted the hazards of disposal of such products, it also acknowledged that manufacturers weren't legally bound under S. 3(g). It emphasised the role of the state and its citizens in maintaining a clean environment, and directed the authorities to educate citizens and provide necessary infrastructure to comply with the MSW and Plastic Rules. It also said that the MNCs, though not liable under the EPR rule, should create more consumer awareness by prominently devoting at least 10% of space/time of each advertisement in print and electronic media to consumer education.

The Tribunal quoted the judgment in *Almitra H. Patel and another. Vs. Union of India and Ors.*, with directions about enforcement of MSW Rules by the Corporation, and also directed installation of technologically advanced incinerators in the wash rooms of all educational institutions, government and private offices, public places, etc. It also pointed to the use of wall mounted twin chamber incinerators with thermal insulation, which incinerate soiled pads and emit less smoke.

5. Kallpavalli Vrishka Pempakamdarula Paraspara Sahayaka Sahakara Sangam Ltd. and Ors. Vs. Union of India and Ors. (25.8.2015):[41]

Initiated on: 25.8.2015

Disposed of on: 25.8.2015

Time in court: --

Judges: J. Swatanter Kumar, J. M.S. Nambiar

Experts: Prof. A.R. Yousuf, Mr. Bikram Singh Sajwan

Region Concerned: Kallpavalli, Andhra Pradesh

Area: Principal Bench, New Delhi

Application no: 92/2013

Status: Disposed off, no costs.

Issue: Environmental harms caused by road construction

Order:

The Tribunal ordered that the respondent, engaged in road construction in the Kallpavalli area, shall not cause any plastic material to be scattered in the site concerned, to prevent pollution caused by plastic and help preserve the state of the environment.

[41] http://document.manupatra.com/Tribunals%20and%20Commissions/NATIONAL%20GREEN%20TRIBUNAL/2001-2012/NGT2015/GT201531081521220612.htm. Offline document available.

6. M/s Madhup Agency Vs. State of Rajasthan &Ors. (31.7.2015):[42]

Initiated on: 5.12.2013

Disposed of on: 31.7.2015

Time in court: 1 year, +7 months

Judges: J. U.D. Salvi

Experts: Dr. D.K. Agrawal

Region Concerned: Rajasthan

Area: Principal Bench, New Delhi

Original Application no: 50/2014.

Status: Disposed off.

Issue: Whether plastic bags without self-carrying feature were covered within the prohibition on plastic bags issued by the Rajasthan government.

Facts:

An application was filed challenging the seizure of plastic materials of 10710 kg from the applicant's go down. The inspection report submitted by authorities showed that only around 1512 kg were plastic bags that could have fit within the prohibition on plastic carrying bags issued by the Rajasthan Government, though they didn't have handles/were not of carrying type. Further, the applicant was engaged only in storing and selling such plastic materials, not in packaging work or selling of any other material. However, it was argued by the authorities that the possibility of this being used as a plastic carry bag couldn't be ruled out, as in the notifications explaining the prohibition.

[42] http://greentribunal.gov.in/Writereaddata/Downloads/50-2014THC(PB-II-Judg)OA31-7-2015.pdf

Order:

The Tribunal noted that the form and attendant circumstances of the plastic bag were more important than the possibility of its use, in determining whether it was contraband. It found that the plastic bags did not have self carrying features, and noted that the seizing authorities didn't mention finding any ancillary material like punching machine/fresh rope/staple, which could be used for converting these bags into carry bags with self-carrying feature. The Tribunal also noted that due to the absence of such self-carrying feature, the bags could constitute an 'integral part of the packaging in which goods are sealed prior to use' under S.3(b) of the 2011 Rules. Further, there was no evidence to show that the applicant was also manufacturing packaging materials, and not just selling them. Thus, the plastic bags seized were not contraband/prohibited carry bags susceptible to seizure under the notification.

The Tribunal also noted that though any seizure and search under S.10 of the EPA was to be in conformity with the Code of Criminal Procedure regarding warrants issued (as far as possible), no criminal proceedings in respect to seizure had been initiated against the applicant here. It quashed the seizure, allowing the application. It ordered that the material be released and handed over to the applicant and disposed of the application.

7. G Senthilkumar Kallagoundenpalayam Vs. The Member Secretary, Pollution Control Board (10.7.2015):[43]

Initiated on: 6.7.2015 (at least)

Disposed of on: 10.7.2015

Time in court: Within 1 month

Judges: Dr. P. Jyothimani

Experts: Prof. Dr. R Nagendran

Region Concerned: Erode, Tamil Nadu

Area: Southern Zonal Bench, Chennai.

Application no: 78/2015.

Status: Disposed off, no costs.

Issue:

- Whether consent had been obtained by a business to reprocess plastic lumps.
- Whether the business was treating its emissions as required by law.

Facts:

An application was filed seeking directions to the TNPCB to take action against M/s Santhya Plastic. This company was carrying on a business in re-processing of plastic lump, which was causing environmental damage to the areas and people around its operating area. The applicant had contended that the quantity of plastic lump being manufactured by the unit was more than what the Board had consented to, and the company wasn't dealing with its trade effluent in the required manner, thus causing air pollution. It also contended that the building plan approval hadn't been obtained by the unit.

The respondent (unit owner) argued that no trade effluent was being emitted and that required processes were in place. Though the Board had initially rejected consent to operate, it had allowed

[43] http://greentribunal.gov.in/Writereaddata/Downloads/78-2015(SZ)OA-Jug-10-07-2015.pdf

such consent later, with certain conditions imposed on the unit, which the unit complied with. It was granted consent to establish and operate on compliance with these conditions. The inspection report showed that the quantum of manufactured re-processed lumps was well within the consented amount, and that a carbon scrubber and a stack for emission from the melting machine were in place. The Tribunal upheld the validity of this report.

Order:

The unit operating without a valid 'consent to operate' from the relevant Board was ordered to pay environmental compensation of Rs. 60,000 (under the polluter pays principle), which it paid immediately. The Tribunal expressed appreciation for the immediate action taken by the unit owner to address the problems raised. It noted that the manufactured amount of reprocessed plastic lump was within the allowed amount, and that the height of a mentioned tank adhered to requirements. It also ordered that the Board carry on continuous monitoring of the unit, and if any violations were found on sudden inspections, then action would be taken immediately. The previous order of the Tribunal closing the unit was set aside, and the TNPCB was directed to pass orders regarding renewal of consent.

Application disposed of, no costs.

8. Him Jagriti Uttaranchal Welfare Society Vs. Union of India & Ors (3.3.2015):[44]

Initiated on: 28.2.2014

Disposed of on: (last found - 24.8.2015)[45]

Time in court:

Judges: J. Swatanter Kumar, J. M.S. Nambiar

Experts: Dr. D.K. Agrawal, Mr. Ranjan Chatterjee

Region Concerned: Uttarakhand-based NGO, but petition concerned India as a whole

Area: Principal Bench, New Delhi

Application no: O.A. 15/2014

Status:

Issue: Extent of plastic ban

Order:

The primary prayer in this application was for banning plastic packaging in food items and to some extent in pharmaceutical items, mainly plastic bottles, multi-layered plastic packages and PET bottle for packaging carbonated soft drinks. It sought phasing out use of plastic polyethylene for non-essential items, thus restricting use of plastic bottles. The Tribunal agreed that restriction on the use of plastic bottles was needed, but allowed time for arguing the matter. It ordered for public notice to be sent to manufacturers and users of pet/multi-layered bottles, if any desired to address the Tribunal on the issue.

Continuation of same case (24.8.2015):[46]

The DGHS, Ministry of Health had issued a draft notification on 29.12.2014, under S. 33 read with S. 26(a) of the Drugs and Cosmetics Act, proposing prohibition of use of polyethylene terephthalate in primary packaging of liquid oral drug formulations, etc., and objections had been invited.

[44] http://www.conservationindia.org/wp-content/files_mf/Public-Notice-Plastic-NGT.pdf
[45] http://www.greentribunal.gov.in/Writereaddata/Downloads/15-2014(PB-I)OA24-8-2015.pdf
[46] http://www.greentribunal.gov.in/Writereaddata/Downloads/15-2014(PB-I)OA24-8-2015.pdf

As majority of submissions opposed the ban, the matter was referred to a high level committee, which established that certain pharmaceutical preparations packaged in PET bottles showed presence of chromium, antimony, etc., at room temperature. It also expressed that considering the precautionary principle, and preventing children, aged people and women in reproductive age from being exposed to theharms of pharmaceutical products in plastic/PET containers may be in public interest.

Order:

As no decision was taken by any ministry regarding the ban, the Tribunal sought submissions from all the parties (The Ministry of Health, MoEF, CPCB, FSSA, and other stakeholders). It asked whether there should/should not be a ban on the use of plastic packaging in food items, and in pharmaceutical formulations of any kind, or whether there should be a partial ban on either (and to what extent).

9. Dr. Irfan Ahmad & Ors. Vs. Mr. Nawang RigzinJora & Ors.(13.1.2015):[47]

Initiated on: 8.10.2013

Disposed of on: 13.1.2015

Time in court: 1 year, 3 months

Judges: J. Swatanter Kumar, J. M.S. Nambiar

Experts: Dr. D.K. Agrawal, Prof. A.R. Yousuf

Region Concerned: Srinagar, Jammu and Kashmir

Area: Principal Bench, New Delhi

Application no: 277/2013.

Status: Disposed off, no costs.

Issue: Non-compliance with MSW Rules.

Facts:

An application was filed with the prayer that the landfill near Achan wetland, Srinagar be closed due to hazards posed to the environment (also, there was difficulty in breathing and the water table was too high for the landfill site to be approved). A writ petition had been filed in the J&K High Court regarding the same matter. Officers had paid a visit to the site, but recommendations made by relevant authorities to take necessary steps were not complied with - the state of the landfill had indeed become worse.

The land had been allotted by Government of J&K to SMC (Srinagar Municipal Corporation) for dumping municipal wastes, but no scientific method had been adopted for disposal till 2006. The SMC had started covering waste with soil and spraying sanitreat powder in accordance with the Rules, 2000. JKPCB (Jammu & Kashmir Pollution Control Board) and MoEF had granted consent and environment clearance to operate the site.

[47] https://d2391rlyg4hwoh.cloudfront.net/downloads/dr_irfan_ahmad_ors_vs_mr_nawang_rigzin_jora_ors.pdf

Order:

The Tribunal ordered the SMC Commissioner to discuss with Government of J&K and assess the costs for setting up the plant, along with collection and disposal of MSW. SMC Commissioner, Secretary - SPCB and Environment Secretary of J&K were held personally responsible for failing to discharge their duties in accordance with law. The SMC was directed to pay INR 14 lakh (1 lakh per year of default, since 2000) to JKPCB, to be used for restoration of the environment. *The judgment in Tribunal in People for Transparency, through Kamal Anand Vs. State of Punjab &Ors. Original Application No. 40(THC) of 2013 was held to apply mutatis mutandis to this case.*

Charges paid by the public to the Municipal Corporation as 'environmental charges' were to be used for setting up plant. All expenditure for the plant was to be under supervision, and made only after specific approval of the committee constituted to ensure proper construction, establishment, operationalisation, as well as optimum running of the plant. The SMC was ordered to seek authorisation of the JKPCB in accordance with Rule 6(2) of Rules of 2000, and the project to set up the plant was to be completed within 1 year.

The Tribunal required the SMC to comply with certain conditions, such as processing treatment of MSW (to process biodegradable materials through composting, RDF, plastic waste, etc; and to process non-biodegradable waste for fuel materials, plastic ingots, etc.). Before dumping waste in the pits, the SMC would ensure a soil lining along with plastic covering. The Tribunal also stated that reducing dumping load by sending the MSW (particularly plastic) to such industries (such as cement plants) that would ensure its use as fuel was dually advantageous: it would ensure fruitful utilisation of waste on segregation and also offer a source of practically free fuel for the industry concerned.

10. Mohali Industry and Commerce Association Vs. State of Punjab &Ors. (13.1.2015):[48]

Initiated on: M.A. on 13.1.2015, O.A on 7.8.2014

Disposed of on: 13.1.2015

Time in court: Around 5 months.

Judges: J. Swatanter Kumar, J. U.D. Salvi

Experts: Dr. D.K. Agrawal, Prof. A.R. Yousuf

Region Concerned: Mohali

Area: Principal Bench, New Delhi.

Application no: M.A. no. 73/2014 and Original Application no. 139/2014.

Status: Disposed off, no costs.

Issue:

- Non-compliance with MSW Rules
- Illegal dumping of wastes by the Municipal Corporation.

Facts:

Application filed to stop illegal dumping of Mohali's industrial, medical, toxic waste in the rivulet Patiala ki Rao and surrounding areas by the municipal corporation, asking Tribunal to direct the corporation to clean and remove all illegally dumped waste. On 7.8.2014, the Tribunal constituted a Committee to visit the site and prepare a report regarding status of the site and dumping. On 29.9.2014, it was noted that effective steps would be taken to remedy shortcomings pointed out by the Committee. A detailed affidavit was submitted by the corporation showing details of the project, measures to be taken regarding MSW and other wastes.

It was decided that Mohali shall form part of the Model MSW Management Plan, 2014, being one of the eight clusters in Punjab. The plant would be established within 2.5 years, and the grievances would thus cease to exist. Also, land acquired for construction of this project was yet to be released

[48] https://d2391rlyg4hwoh.cloudfront.net/downloads/mohali_industries_vs_state_of_punjab.pdf

by governmental authorities by notification, as per a previous judgment. Applicant contended that even after filing the current application, no steps had been taken to remedy the illegal dumping. Further, industrial waste wasn't being collected and dealt with by the corporation in accordance with the MSW Rules, 2000.

Order:

The Tribunal ordered all acquisitions to be completed within 1 year, with the MSW plant completed and operational by January 2017. It stated that the judgment in People for Transparency would apply mutatis mutandis, and that the present site would be treated as a 'temporary dumping site'. It ordered door-to-door collection and manual segregation at collection, loading and dumping sites, with recyclable waste to be given to persons licensed to recycle specific materials (especially those licensed to recycle plastic). *'Every effort would be made to send this plastic waste and other allied waste that could be used as fuel, to such industry and units which can consume such waste as fuel.'* The Tribunal also ordered the construction of pits with proper lining for dumping at these sites, along with practices such as covering with soil and spraying of disinfectant.

The Tribunal ordered the corporation to prepare a schedule of environmental charges and collect waste from doorsteps and provide dustbins of distinct colours. Further, the corporation was to ensure appointment of officers to enforce compliance, and also periodically submit reports to authorities who would inspect the temporary site.

The Tribunal said that it would pass coercive orders under the NGT (National Green Tribunal) Act if the above orders weren't complied with and that any person had the liberty to approach the Tribunal on this matter if there was lack of compliance.

2014

1. Latif Beg &Ors. Vs. MoEF&Ors. (30.5.2014):[49]

Initiated on: 30.5.2014

Disposed of on: 30.5.2014

Time in court: --

Judges: J. Swatanter Kumar, J. M.S. Nambiar

Experts: Dr. D.K. Agrawal, Prof. A.R. Yousuf, Dr. R.C. Trivedi

Region Concerned: Bareilly, Uttar Pradesh

Area: Principal Bench, New Delhi

Application no: M.A. 67/2014 in O.A. 5/2014 and O.A. 6/2014

Status: Disposed off.

Issue: Non-compliance with MSW Rules.

Facts:

Among other violations, an MSW plant was failing to separate plastic waste from inert waste properly. It was also found that the unit owner didn't have valid authorisation and consent for operation of the MSW plant.

Order:

The plant was directed to close, and re-apply for consent and authorisation once it cured all the deficiencies pointed out.

[49] https://indiankanoon.org/doc/133371108/

2. Neel Choudhary Vs. State of Madhya Pradesh, through Principal Secretary, Aawas Evam Paryavaran Vibhag and Ors. (6.5.2014):[50]

Initiated on: 6.5.2014

Disposed of on: 6.5.2014

Time in court: --

Judges: J. Dalip Singh

Experts: Mr. P.S. Rao

Region Concerned: Bhopal, Madhya Pradesh

Area: Central Zonal Bench, Bhopal

Application no: 18/2013

Status: Disposed off, no costs.

Issue: Non-compliance with MSW Rules

Facts:

It was found that many marriage halls and gardens didn't ensure regular lifting of kitchen waste, leading to choking of sewer lines.

Order:

The Tribunal directed that owners and managers of marriage/party gardens and functions halls must comply with the MSW Rules, and ensure that plastic and disposable cutlery and containers not be mixed with other solid waste.

[50] https://indiankanoon.org/doc/119830025/; http://www.greentribunal.gov.in/Writereaddata/Downloads/18_2014(App)(CZ)_6May2014_final_order.pdf

3. Babu Lal Jajoo Vs. Chief Secretary to Govt. of Rajasthan and Ors. (14.3.2014):[51]

Initiated on: 14.3.2014

Disposed of on: 14.3.2014

Time in court: --

Judges: J. Dalip Singh

Experts: Mr. P.S. Rao

Region Concerned: Rajasthan

Area: Central Zonal Bench, Bhopal

Application no: 8/2014.

Status: Disposed off.

Issue: Effective steps taken towards ban on plastic carrybag in Rajasthan.

Facts:

An application was filed with the prayer to direct the Respondents (municipal councils of different cities in Rajasthan, the Department of Environment and the Department of Urban Development and Housing) to take effective steps regarding the complete ban and prevention of use of plastic carry bags.

Order: The Tribunal referred to the Sandeep Lahariya judgment, and stated that the State of Rajasthan would be required to submit the compliance report by 31.5.2014. No fresh direction was made in this case, as the Sandeep Lahariya judgment had already ordered the required measures. The Application was disposed of.

[51] https://d2391rlyg4hwoh.cloudfront.net/downloads/babu_lal_jajoo_v_chief_secretary_to_govt_of_rajasthan_and_othrs.pdf

4. **Sonyabapu Vs. The State of Maharashtra, Through: The Secretary, Revenue and Forest Department and Ors.**[52]

   AND

   Prabhakar Pratap Pangavhane Through its Power of Attorney Holder Avinash Prabhakar Pangavhane Vs. State of Maharashtra Through the Secretary, Environment Department and Ors. (24.2.2014):[53]

   Initiated on: WP 2059/2013 and WP 9855/2013 in Bombay HC, and on 24.2.2014 in the NGT

   Disposed of on: 24.2.2014

   Time in court: Within 1 year

   Judges: J. V.R. Kingaonkar

   Experts: Dr. Ajay A. Deshpande

   Region Concerned: Ahmednagar, Mumbai, Maharashtra

   Area: Western Zone Bench, Pune

   Application no: 7/2013, 36/2013

   Status: Disposed off, no costs.

   Issue: Lack of prescribed emission standards for brick kilns.

   Facts:

   Complaints were lodged regarding fugitive emissions arising from brickkilns run by the respondents. The Board had laid down guidelines for operation of these kilns, including that rubber, plastics and hazardous wastes not be used as fuel to avoid toxic emission.

   Order:

[52] https://indiankanoon.org/doc/52728118/?type=print
[53] https://indiankanoon.org/doc/118328374/

While the respondents denied ever using such banned fuels, the Tribunal noted that the MPCB (Maharashtra Pollution Control Board) had failed to mention anything about or set emission standards while considering applications for clamp type/traditional brick kilns. It found that the Board had covered these kilns under the consent regime without prescribing emission standards for permissible levels of pollution, which form the core part of consent under the Air and Water Acts. It emphasised that such standards were essential prerequisites for appraising these consent applications. The kilns were ordered to stop running till they obtained necessary consent from the MPCB, and the MPCB was to notify emissions standards within 4 months.

5. Court On Its Own Motion Vs. State Of Himachal Pradesh &Ors. (6.2.2014):[54]

Initiated on: 6.2.2014

Disposed of on: 6.2.2014

Time in court: --

Judges: J. Swatanter Kumar, J. U.D. Salvi

Experts: Dr. D.K. Agrawal, Mr. Bikram Singh Sajwan

Region Concerned: Manali, Himachal Pradesh

Area: Principal Bench, New Delhi

Application no: 237/2013.

Status: Disposed off.

Order:

This case discussed the problems regarding Manali's environmental carrying capacity having crossed its physical and ecological limits, due to rise in tourism, population, air pollution, etc. The Tribunal noted that to ensure a clean and decent environment, authorities must ensure cleanliness and tourists must cultivate a habit of not littering/spoiling the beauty and environment of the glacier by throwing plastics and other wastesin it. The Tribunal Issued directions for the same, including: 'Carrying and/or use of any kind of plastic bags, packaging material of food or other items at Rohtang Pass is strictly prohibited. Littering of any kind in, around and also en route Rohtang Pass is also strictly prohibited.'

[54] https://indiankanoon.org/doc/82959019/

2013

1. **Paryavaran Mitra (Janvikas) &Ors Vs. Gujarat State Pollution Control Board &Ors. (20.12.2013):**[55]

Initiated on: 26.6.2013

Disposed of on: 20.12.2013

Time in court: Almost 6 months

Judges: J. V.R. Kingaonkar

Experts: Dr. Ajay A. Deshpande

Region Concerned: Rajkot, Gujarat

Area: Western Zonal Bench, Pune

Application no: 131/2013.

Status: Disposed off, with costs.

Issue:

Non-compliance with MSW Rules, poor management of landfill near Nakravadi

Facts:

Poor management of an authorised landfill (near Nakravadi) under PWM Rules 2011, by the Rajkot Municipal Solid Waste Disposal, resulted in dispersion of waste affecting several hundred villageresidents. It caused contamination of groundwater and degradation of quality of farm lands. The CPCB said it had no role to play in municipal affairs, as authorisation was granted and monitoring was done by the GPCB.

Order:

[55] https://d2391rlyg4hwoh.cloudfront.net/downloads/paryavaran_mitra_vs_gujarat_pollution_control_board.pdf

The Tribunal held that the application was within the limitation period. The prayer to close the landfill was dismissed, as the location of the landfill was not found to be illegal/improper. The Tribunal noted that stopping the processing of waste would cause more damage, and ordered proper compliance with the rules. It applied the polluter pays principle, stating that village residents having agricultural lands/residences within 500 metres of the epicentre of the site may be identified and paid Rs. 20,000 each, by recovering money from HBEPL. It also stated that the CPCB does have authority to issue orders to any industry/authority for violation of standards and rules. The Application was disposed of, and the Tribunal ordered the respondents to pay INR 1,00,000 together to the applicants.

2. Dr. Subhash C. Pandey Vs. State of M.P. and Ors. (19.12.2013):[56]

Initiated on: 19.12.2013

Disposed of on: 19.12.2013

Time in court: -

Judges: J. Dalip Singh

Experts: Mr. P.S. Rao

Region Concerned: Madhya Pradesh, Chhattisgarh, Rajasthan

Area: Central Zone Bench, Bhopal

Application no: 58/2013.

Status: Disposed off.

Issue: Insufficient steps taken by authorities to tackle pollution caused by immersion of idols in water bodies.

Facts:

An application was filed against states of Madhya Pradesh (MP), Chhattisgarh, Rajasthan and their PCBs for not taking necessary steps against immersion of idols in water, and not regulating and controlling such immersion, which led to hazardous substances being released. The applicant contended that there was:

- No awareness of designated areas for immersion and no notification of areas by PCBs
- PCBs weren't conducting educational programmes regarding manufacture of idols with eco-friendly materials
- PCBs weren't conducting awareness programmes regarding immersion (segregation of garlands, decorating plastic materials, etc.)
- PCBs were not analysing pre and post-immersion quality of water, and not collecting debris often enough.

[56] https://d2391rlyg4hwoh.cloudfront.net/downloads/dr__subhash_pandey_vs_state_of_mp_and_ors.pdf

Notices were issued to PCBs of the 3 states on 22.8.2012. Miscellaneous applications were joined during pendency of the original application, all seeking change in location of approved immersion site (as the current site could lead to pollution of River Anas, which was the only source of drinking water for Jhabua town). Compliance reports were filed by the states as required, showing that immersion related pollution/readings were within permissible limits. However, the state of MP was ordered to take stricter action against stagnating debris in immersion spots in lakes. PCBs also directed relevant authorities to carry out pre and post immersion monitoring of water bodies.

Order:

The Tribunal noted that, as far as possible, immersion should not be done directly in rivers and lakes, but in confined ponds etc., as per 2010 guidelines, to enable removal of debris without contamination of these bodies. The Tribunal also appreciated the Taziya Committee's decision to switch to biodegradable materials in idol-making, and the role of religious leaders in generating awareness about this issue. The Tribunal directed authorities to encourage people to use smaller idols and erect pandals in public places only with the permission of authorities. Further, it directed PCBs to take samples at regular intervals in order to help relevant authorities take effective measures.

Application disposed of.

3. Satish Kumar Vs. Union of India &Ors. (12.12.2013):[57]

Initiated on:

- Mahavir Singh Vs. UOI &Ors. - 29.4.2009 as W.P (C), Delhi HC, and transferred to the NGT on 6.2.2013 by a Bench comprising of CJI Rajiv SahaiEndlaw and J. Neeraj Kishan Kaul.
- Satish Kumar Vs. UOI &Ors.

Last heard on: 10.8.2016

Time in court: Mahavir Singh Vs. UOI &Ors. - 7 years + 3.5 months, Satish Kumar Vs. UOI &Ors. -

Judges: J. Swatanter Kumar, J. U.D. Salvi

Experts: Dr. D.K. Agrawal, Mr. P.S. Rao, Mr. Ranjan Chatterjee

Region: Delhi-Haryana (Mundka, Neelwal, Gherawa, etc.)

Area: Principal Bench, New Delhi

Application no: 56 + 57/2013 (56 - Satish Kumar Vs. Union of India &Ors, 57 - Mahavir Singh vs Union of India &Ors).

Status: Disposed off

Issue: Non-compliance with MSW Rules

Facts:

Satish Kumar filed a writ petition - 3013/2010 (after making representations to several authorities) to stop the operation of illegal industries causing pollution by burning plastic, leather, rubber, motor engine oil, etc. He also sought restoration of environment along with compensation to the residents of Mundka village. Mahavir Singh filed a similar writ - 7302/2009, regarding villages of Neelwal, Gherawa, etc., along the Delhi-Haryana border, due to pollution caused by illegal and unauthorized industrial activities of shredding, cleaning, recycling, burning of plastic, rubber articles or such other waste materials. Both cases were addressed together.

[57] https://indiankanoon.org/doc/81588383/

The court noted that authorities had to be approached to take cognizance of these issues, despite the *MC Mehta v. UOI judgment* ordering industrial activities falling under 'F' category in Delhi's Master Plan in residential/non-commercial areas to be shut down immediately. There was resistance to sealing of such industries, saying that it had been notified as an industrial area. It was found that, in 2010, operation of industries in Gherawa and Nangloi had stopped, but operations in other areas like Mundka were still continuing. The HC directed the Government of NCT Delhi to take appropriate action as it had the statutory authority to take action (criminal prosecution or sealing/repossess, etc.). The petitions were then transferred to the NGT in 2013.

The Supreme Court had ordered the formation of a monitoring committee comprising Chief Secretary, Government of NCT, Delhi, Vice-Chairman, DDA,Commissioner of Police, Delhi, Commissioner, Municipal Corporation, Delhi for stoppage of illegal industrial activities:

- The DDA was to take action against industries in operating in non-conforming areas,
- The Municipal Corporation and the Delhi Pollution Control Committee were to take action against polluting enterprises.
- The Commissioner of Industries was ordered to submit a report to the SC on decisions taken in the meeting.

Despite these measures, the menace of burning plastic, leather, etc., still persisted in some measure.

Order:

The Tribunal directed that no burning would take place in areas of Mundka and Tikri-Kalan and called for the status report. The Plastic Waste Dealers Association was impleaded as a respondent. The Tribunal noted its displeasure at the police's failure to prevent such burning and collect evidence immediately. As the applicant raised the use of plastic waste in road construction, the Tribunal impleaded theCentral Road Research Institute, New Delhi and the Central Institute of Plastic Engineering and Technology, Chennai for authoritative comments.

No one disputed the environmental damage caused by burning plastic, but the PVC and PWDA stated their involvement only to the extent of business in segregation of plastic, which they claimed 50,000 people made their living from. PWDA said that they were operating in the areas concerned

only because they had been displaced from their earlier site due to a fire. According to thePWDA, they transported all the plastic waste to recyclers, keeping none with them. On invoices being produced by the PWDA, the Tribunal noted that there was no indication of what had been done with the non-marketable plastic waste after segregation.

It noted photographs which showed burning of plastics at such sites, and the status report that showed storage of huge quantities of plastic wastes at the sites. The report also showed that *'recycling of plastic is carried out in 5 steps: (1) plastic collection, (ii) manual sorting, (iii)chipping, (iv) washing, (v) pelleting. It further reveals that manual sorting involves work of segregation of the plastic scrap into PET (polyethylene terephthalate), HDPE (high-density polyethylene and other(which include the variety of co-polymer and PVC) from other than scrap materials like rock, nails, metals etc.'* The Tribunal noted that all these facts together suggested that even the segregation work was being done recklessly by burning plastic in the open to access the metals.

Here, the Tribunal discussed the nature of plastic, its commercial value, the dangers of disposing of plastic waste inadequately, the toxicity of combustion products and consequences for pollution. It discussed whether *'we therefore (have) to oust such material from use which on littering or unregulated disposal turns its virtue into vice.'* It then discussed 3 methods of disposal - recycling, burial and incineration, as well as the report submitted by CIPET on plastics used for roads. It noted the standards of plastic waste management under Rule 6 of the 2011 Rules, stressing on such handling being a regulated affair, and also highlighting the importance of the Municipal Corporation's role in ensuring compliance with the Rules.

The Tribunal noted that the case here *'involves collection, storage, segregation, transportation, processing and disposal of plastic waste and it is incumbent upon the dealers of plastic waste not to compromise the safety of environment for any reason whatsoever.'* It also pointed out that even though the PWDA claimed to have been forced to settle here for lack of alternative premises, no one had the right to engage in illegal activities that damaged the environment. It further noted that the applicants had just mentioned the general ill-effects of open burning, but hadn't given specific instances that would have helped describe the dimensions of damage caused.
To quantify the damage, the Tribunal said the following was required to be known:

- The extent of area in use and occupation of each plastic waste dealer.
- Amount of plastic waste handled by each of the plastic waste dealers over the years since the occupation of the area for their business.
- Amount of plastic waste not fit for recycling.
- Any other data relevant for the purposes of the quantification of the damages caused.

It finally ordered that:

- All business in segregation of plastic and transfer to recyclers/disposal without registration would be stopped.
- There shall be no unregulated open burning of plastic/rubber, etc. in India.
- All municipal corporations would coordinate waste management systems, set up systems for use of plastic waste inroads/ in co-incineration plants for generation of energy in accordance with law, incorporate necessary provisions in their bylaws for enforcement of these rules.
- Authorities were to work out a plan for restoration of lands, along with costs incurred, and submit a report within a month from the date of this order.
- The parties would also file an affidavit with the details of the land and plastic waste as detailed above.

The original applications were to remain pending for assessment of damages and incidental orders.

Continuation of same case (23.4.2014):[58]

Order:

State of Haryana's report was ready, and the Tribunal ordered for notice to be issued to CPCB to prepare status report. It clearly stated that NCT, Delhi would have to clearly state what steps it had taken for collection and disposal of plastic waste in Delhi, and that it wouldn't postpone the next hearing on anybody's request.

Continuation of same case (24.11.2014):[59]

Order:

[58] http://admin.indiaenvironmentportal.org.in/files/plastic%20waste%20NGT%2023Apr2014.pdf
[59] http://admin.indiaenvironmentportal.org.in/files/polluting%20units%20Delhi%20NGT%2024%20Nov%202014.pdf

Status reports of NCT, Delhi and the Municipal Corporation were filed, but not by the police and the DPCC. The Tribunal ordered the DPCC, NCT and Municipal Corporation to issue notices to 177 polluting units, stating why they shouldn't be directed to close permanently, and pay compensation for restoration of degraded environment. It also ordered the police to conduct physical inspections of these areas and report this at the next hearing. Fines of INR 10,000 were imposed on all the respondents.

Continuation of same case (24.2.2015):[60]

Order:

The Tribunal noted that the municipal corporation hadn't taken action and that plastic wastes continued to fill the agricultural fields, with segregation and other illegal activities still going on. The Tribunal exonerated people segregating plastics, who it stated were small traders not causing pollution. It directed formulation of a plan to restore the affected land at the cost of the land owners (recovered as arrears in land revenue). It ordered the authorities to enforce and follow the order dated 12.12.2013, and that competent authorities must prosecute violators of the 2011 Rules. It stated that authorities must ensure that nobody dumps in the same fields until plan was implemented, and that this process was to be completed within 3 months (with status report on the next hearing).

Continuation of same case (23.7.2015):[61]

Order:

The Bench noted that it didn't see concerted efforts of NCT, Haryana PCB, etc. in restoring lands under order dated 12.12.2013, but noted that the villages seemed to be falling within limits of Government of NCT Delhi now. It ordered that NGT be informed of progress regarding restoration.

Continuation of same case (29.7.2016):[62]

Order:

[60] http://admin.indiaenvironmentportal.org.in/files/plastic%20waste%20burning%20NGT.pdf
[61] http://admin.indiaenvironmentportal.org.in/files/plastics%20Delhi%20NGT.pdf
[62] http://admin.indiaenvironmentportal.org.in/files/plastic%20waste%20disposal%20NGT%20order%20Delhi.pdf

De-sealing of property after clearing of scrap material was allowed by the Tribunal, to prevent the land from lying vacant without yielding any benefit.

Continuation of same case (10.8.2016):[63]

Order:

The Tribunal reiterated the clarification that the Satish Kumar 695/2015 order banning the burning of plastic also restrained businesses of segregation of plastic waste, and its eventual transfer to recyclers or disposal, contrary to, and without registration under, the provisions of Plastic Waste (Management and Handling) Rules, 2011.

[63] http://www.greentribunal.gov.in/Writereaddata/Downloads/56-20013(PB-II)OA10-8-2016.pdf

4. Sandeep Lahariya Vs. State of Madhya Pradesh &Ors. (11.11.2013):[64]

Initiated on: 8.2.2013

Last heard on: Last file found - 24.12.2014

Time in court:

Judges: J. Dalip Singh

Experts: Mr. P.S. Rao

Region Concerned: Madhya Pradesh

Area: Central Zonal Bench, Bhopal

Original application no: 04/2013.

Status: Disposed off, no costs.

Issue: Non-compliance with 2011 Rules, and the ban on plastic bags.

Facts:

A case was filed as PIL in writ petition in the HC of MP by Sandeep Lahariya, with a prayer to direct respondents to ensure compliance with the 2011 Rules - to stop use, sale, storage of plastic carry bags and packaging. He contended that the standards of manufacture and disposal of polythene were not being followed leading to pollution and health hazards. In accordance with the Supreme Court's directions in the Bhopal Gas Peedith case, the writ petition was transferred to this Principal Bench, NGT, and subsequently to the Central Zonal Bench on its constitution.

The applicant contended that even though plastic carry bags of less than 40 microns in thickness were banned, they were being used indiscriminately, resulting in huge quantity of plastic waste all over MP causing health hazards for humans and cattle and environmental damage. He stated that the municipal bodies and the MPPCB weren't paying heed to the need for protection of the

[64] http://www.indiaenvironmentportal.org.in/files/plastics%20NGT%2011Nov20131.pdf

environment and health of the public, even though they were the competent authorities to implement the Rules.

All the respondents agreed that the indiscriminate use of plastic carry bags was a serious environmental hazard, and manufacture and sale of such less than 40 microns was non-permissible.

Order:

The Tribunal thus felt it appropriate to pass an injunction against anyone doing the same, which it stated in its orders on 8.2.2013 and 8.4.2013 (*there shall be no manufacture, sale, storage or use of any plastic bags with thickness less than 40 microns by the shopkeepers, manufacturers, industrialists and any other person dealing in such trade in any part of the State of Madhya Pradesh*).

It issued directions to all relevant authorities to ensure compliance, conduct regular inspections and submit status reports. The Tribunal discussed Rules 3, 4, 5, 8, 9, 10, 11 and 12, of the 2011 Rules. The MPPCB and the corporation stated that they were taking all necessary steps to fulfil their statutory duty - regular raids, checks, awareness programmes, directions to officers to enforce 2011 Rules.

The Tribunal noted the seriousness of indiscriminate use of plastic/polythene carry bags and unregulated discarding of such, referring to the state's duty to protect and improve the environment under Art. 48A, and the citizen's duty to do the same under Art.51A(g) of the Constitution (due to the ill-effects of pollution affecting humans, animals, plants, environment, etc.). It highlighted that citizens needed to have regard for all living creatures and how they are affected by pollution that we consciously/unconsciously cause.

It noted that the 2011 Rules emphasise recycling but fail to mention 'REDUCE'. It stated that the following directions would not only apply to Gwalior and Bhopal, but to the entire state of MP AND Chhattisgarh and Rajasthan, as all fall within the Bench's jurisdiction.

It addressed the nature of plastic bags, the process of their manufacture and harms of toxic chemicals, environmental issues caused by indiscriminate littering of plastic waste (released by the

CPCB in 2013), plastic waste fires, and thus the need for encouragement of qualified substitutes to such banned bags. It suggested evolving a tax preferential policy to manufacturers of biodegradable plastic bags and substitutes.

The Tribunal emphasised the need for Rule 10 to be enforced (general public pays for cost of bag) to reduce consumption. It also suggested a tax on use of plastic bags, increasing the value of the product, thus leading to more reuse and recycling.

The Tribunal stated that improving the solid waste management system and addressing littering habits through education were huge challenges. It said the solution also lies in segregation of waste at source (at home and arrangement for recycling of all recyclable waste).

It then discussed plastic bans in other states and countries - about how it affected the biodegradable materials' industries, how taxes play a role (Denmark's general waste tax, China's bag tax). It referred to NGT's order in the case of *Goodwill Plastic Industries Vs. UT of Chandigarh &Ors.*, and directed the respondent authorities to prepare and implement a time bound action plan to completely dispense with the use of non-biodegradable carry bags in MP, Chhattisgarh and Rajasthan. It stated that there was a need for the PCBs in all 3 states to make certain areas (highly polluted ones) 'plastic and polythene free zones' and ban the manufacture, sale and distribution of plastic carry bags (referring to Chandigarh and Tripura's notifications).

It was pointed out that hardly about 2000 workers were involved in waste removal and sanitation in a city of population of about 20 lakh (Bhopal), and that the authorities should consider whether such a meagre work force and limited infrastructure facility were enough to effectively implement the 2011 Rules. *'The excuse of financial constraints must be weighed in the light of the expenses to be incurred both by the state as well as individual citizens on problems of health and disease..' 'It hardly needs to be stated that the scales shall weigh heavily in favour of protecting the health of the citizens, as life is more precious and Article 21 of the Constitution mandates that. '*

The Tribunal stated that searches and seizure of substandard bags were taken up after a long gap, only on intervention by courts, and that there were too few in number. It emphasised that these

needed to be done on a regular basis- on a surprise basis - so that these petitions need not even be filed before it.

The need for regular awareness drives under Rule 6(c)(v) could be addressed by including a chapter, in the subject Environment, on pollution due to indiscriminate use of plastic carry bags and other pollutants, and their substitutes (biodegradable, cost effective and environment friendly). The Tribunal brought up the role local administrations, handicraft boards and small industries could play in providing raw material for manufacture of environment friendly carry bags, generating employment and creating an alternative.

It recognised the principle of Extended Producer Responsibility under Rule 2(g), along with Absolute Liability, Polluter Pays, Precautionary Principle and Public Trust Doctrine. It specifically mentioned the role of the municipal authorities in involving the manufacturers for ensuring setting up of collection system of plastic waste under Rule 6(c)(iii), which many authorities seemed to have not noticed. It also mentioned Rule 6(d), where the authorities could involve the EPR principle against the manufacturers individually/collectively, including providing finance.

The Tribunal stated that municipal authorities had not been able to satisfactorily carry out their tasks under the Rules, and that it was surprising that they hadn't involved the manufacturers in the process. It directed the PCBs of the 3 states to ensure compliance with Rules 4 and 6 specifically, within 3 months from the date of issue of the order, apart from other regular measures to be carried out.

It emphasised that provisions of various rules and procedures adopted by municipal authorities had to be incorporated in their bylaws under Rule 6, and that the Tribunal hadn't been apprised of compliance with Rule 6(g) in any of these states.

It then discussed need for registration of manufacturers under Rule 9(c) and fixing of minimum price after taking into consideration waste management costs under Rule 10 (for discouraging high consumption). It noted the advantage of working out a mechanism for recovering the cost of waste

management at the initial stage of manufacture, as the plastic bags change hands many times after that stage.

It directed authorities in these states to monitor implementation of the 2011 Rules, and file affidavits on progress made by way of quarterly reports (from 31.3.2014 till 31.12.2015).

The application was disposed of, with no costs.

5. A.T. Yuvaraj Erode District Vs. Rani Chemicals Kalingarayanpalayam&Ors. (4.9.2013):[65]

Initiated on: 4.9.2013

Disposed of on: 4.9.2013

Time in court: --

Judges: J. M. Chockalingam

Experts: Prof. D. R. Nagendran

Region Concerned: Erode, Tamil Nadu

Area: Southern Zonal Bench, Chennai

Application no: 174/2013.

Status: Disposed off, no costs.

Issue: Illegal manufacture of bleaching liquid and plastic/rag pulp.

Facts:

The units of a bleaching manufacturer and a plastic/rag pulp manufacturer were both found to be emitting dangerous effluents, making water unsuitable for drinking purposes. The 1st respondent, involved in illegal manufacture of bleaching liquid, stored chlorine cylinders without any safety measures, or approval under Gas Cylinder Rules, 2004 (was storing 60 cylinders, limit is 5 without a licence). After complaints were lodged by the public, the District Environmental Engineer's office inspected the area and found chlorine cylinders unsafely stored. The applicant contended that negligent use of cylinders had released chlorine gas into the air, causing eye irritation and respiratory problems for residents of neighbouring villages.

The application was filed to bar manufacturers from operating their industrial units till appropriate licenses were obtained under the Air and Water Acts.

Order:

[65] https://d2391rlyg4hwoh.cloudfront.net/downloads/at_yuvraj_vs_rani_chemicals.pdf

The Tribunal noted that the grievance regarding alleged air and water pollution had come to an end as the District Collector had already sealed the 2 units pursuant to Tribunal's order dated 25.7.2013. The Tribunal ordered that they not be reopened without the consent of the DC.

Application disposed of with no costs.

6. M/s Goodwill Plastic Industries &Ors. Vs. Union Territory Chandigarh &Ors.; and Jarnail Singh Anr. Vs. Union Territory Chandigarh Anr. (8.8.2013):[66]

Initiated on: 17.4.2013[67]

Disposed of on: 8.8.2013

Time in court: 3.5 months

Judges: J. Swatanter Kumar, J. U.D. Salvi

Experts: Dr. D.K. Agrawal, Mr. P.S. Rao, Mr. Ranjan Chatterjee

Region Concerned: Chandigarh

Area: Principal Bench, New Delhi

Application no: 26/2013, 53/2013.

Status: Dismissed

Issue: Whether the ban on plastic bags extended to businesses involving other plastics.

Facts:

An application was filed challenging the notification issued in Chandigarh (banning use, manufacture, transport, etc., of polythene/plastic carry bags), saying that theban was only on polythene bags, and not other plastics. The applicants carried on business involving virgin plastics, not recycled ones.

Order:

The Tribunal stated that the ban was only on polythene bags - here, valid reasonable restriction had been imposed partially on business in plastics (only polythene bags, nothing else). It also noted the direct nexus between the object of notification and EPA, i.e., public interest was greater than small economic and business interests of applicants. It noted the harms of plastic bags and some measures taken by other countries. No fault was found in issuance of notification by Chandigarh

[66] https://d2391rlyg4hwoh.cloudfront.net/downloads/goodwill_industries_vs_union_territory__chandigarh.pdf

[67] http://www.greentribunal.gov.in/Writereaddata/Downloads/53-2013(THC)(OA)_16Apr2013.pdf

Administrator, even though states of Haryana and Punjab hadn't issued the same. The Tribunal said it required the latter two to consider this problem and issue appropriate notifications. It considered it appropriate to direct authorities in all states to look into biodegradable/compostable bags instead of polythene bags, and stated that no legal/constitutional infirmity was found in the notification issued here.

7. Goa Foundation and Peaceful Society Vs. Union Of India &Ors (18.7.2013):[68]

Initiated on: 30.5.2012

Disposed of on: 18.7.2013

Time in court: 1 year + 1.5 months

Judges: J. Swatanter Kumar, J. U.D. Salvi

Experts: Dr. D.K. Agrawal, Prof. A.R. Yousuf, Dr. R.C. Trivedi

Region Concerned: Western Ghats (Goa, Kerala, Maharashtra, Gujarat, Karnataka, Tamil Nadu)

Area: Principal Bench, New Delhi

Application no: M.A. NO.49/2013 in application no: 26/2012.

Status: Disposed off.

Issue: Protection of ecologically sensitive zones in the Western Ghats.

Facts: an application was filed seeking directions to governmental authorities regarding protection of ecologically sensitive zones in the Western Ghats. The application mentions the Pronab Sen Committee's report on determining ecologically sensitive areas, which also stated that no plastic bags should be allowed in shops, settlements and built up areas/to be developed areas in different ESZs within the larger ESA of Western Ghats. No other relevance to plastics.

[68] https://indiankanoon.org/doc/161378671/

2012

1. M/S Amman Plastics Vs. Tamil Nadu Pollution Control Board (28.2.2012):[69]

Initiated on: 18.10.2011

Disposed of on: 28.2.2012

Time in court: 4 months 10 days.

Judges: J. Shri. C.V. Ramulu

Experts: Prof. R. Nagendran

Region Concerned: Erode, Tamil Nadu

Area: Principal Bench, New Delhi

Application no: 25/2011.

Status: Disposed off.

Issue: Granting of consent to operate plastic recycling unit.

Facts:

An application was filed by the applicant seeking directions to TNPCB to inspect his plastic recycling unit and grant consent to operate said unit. A writ petition filed earlier saw the Madras HC order the TNPCB to inspect the site, make a report and check whether unit had obtained the required permissions for operations. Only after that would the TNPCB be allowed to make a decision as to whether the unit should be allowed to continue running or whether correctional steps were required. The TNPCB Chairman was to complete this process within 4 weeks from the date of issue of the order. The HC also said that if any 'serious problem has been caused by the unit, it must be looked into and controlled or extinguished.

TNPCB carried out the inspection and issued directions to correct certain defects found in the functioning of the unit. On non-compliance with these directions, the unit was sought to be closed

[69] https://d2391rlyg4hwoh.cloudfront.net/downloads/ms_amman_plastics_vs_tnpcb__2012_.pdf

down. The applicant didn't take action with regard to this, but filed the current application (after TNPCB issued the directions) seeking consideration of representation made.

Order:

The Tribunal ordered TNPCB to revisit and re-inspect the unit and consider the representation made by the applicant.

Annexure 2: Case Studies of Informal Sector Service Providers

1. Bidhan Giri – Cloth stitching and alteration

Name: Bidhan Giri

Age: 47 years

Education: 8th standard in Kolkata

Occupation: Cloth stitching/alteration in New Delhi

Bidhan Giri sits under a dense tree with his sewing machine stitching and altering clothes. It has now been 11 years since he first started doing this. For stitching and altering clothes he requires a machine (one time investment), thread, buttons, bag zipper and scissors. He has managed to spread his business through word of mouth. Giri charges his customers anywhere from 10 rupees to 40 rupees, depending upon the type of cloth and skills required. He sometimes works for 4 hours, sometimes 10 and even 14 hours at times. On an average he works for about 8-9 hours a day. He goes regularly to work and takes a break occasionally or during an emergency in the family.

Giri says he has learned these skills from a friend, prior to which he was a puncture *mistry*. He's the sole breadwinner of his family which includes his wife and three children. His eldest child, his son, age 24 holds a M.A. degree and his two daughters, aged 21 and 19 are doing Bsc. He exclaims with delight when he says his son aspires to become a teacher and is currently preparing for the same. He wants his elder daughter to learn the art of cloth altering as she is the only child interested in learning it.

For Giri, demonetisation has cost him his business. He is not able to understand why his sales are continuing to decline even after three years. He says, 'wahi log, wahi society hai....pata nahin insaan kanjoos ho gaya kya.' Before 2015, he was able to earn 700-800 rupees per day. It has now come down to 250-300 rupees a day. Giri says people like him are not able to save money, and even if they manage to do so, it is not very substantial.

Expense/Income	Item	Average amount (rupees)
Expense	House rent	5,000
	Water Bill	500-600
	Electricity	3,000
	Household expenses	400-500
Income	Cloth altering/Stitching	9,000 -10,000
Savings		***0***

Giri finds it surprising that his sales are steeply declining. He is not hopeful about his future employment as he says, 'ab 50 saal ki umar mein humein kaun naukri dega?' underlining the struggle he has overcome as a result of growing older each day.

Ironically, his sales have been declining despite the fact that the demand for cheaply available clothes is at peak. These clothes tear easily and need fitting. A reason for this could be that people are disposing clothes rather than getting them altered/stitched.

Giri's nephew, who is in the same business, has the same complaints. He earlier blamed winters for the fall in sales, but summer months hymn the same chorus.

Giri does not have any strategy or plans to combat the ongoing crisis, majorly because he is retiring in three years.

He wants the government to acknowledge and formalise the 'footpath' sector. In his view, the informal sector has been neglected since decades. He also stresses the growing income disparity to be a pressing issue.

Giri wants the government and governmental agencies to keep a track of GST and how it can be carefully accounted for, the amount of jobs and who is getting the job.MCD continues to harass the informal roadside stalls. He will never advise the younger generation to venture into this occupation.

2. Gully Singh – Key maker

Name: Gully Singh

Age: 42 years old

Education: 5th standard from a public school in Delhi

Occupation: Key maker

Singh sets up his key making store with his father-in-law every morning at 8am in Janakpuri along a busy main road, as he has been doing for the past 25 years. His father-in-law has been running this roadside business for the past 40 years. Although his family is originally from Punjab, they have been in New Delhi for two generations. 'This business is in the family. My father, my grandfather, my great-grandfather, we have all done this work. I learned from them.' Singh learned the business from his father and father-in-law. He lives in a small apartment with his family just 5 minutes away.

Despite this long-standing tradition, Singh is determined that his children do not follow in his footsteps. 'This work isn't great…my hope for them is that they study hard and go work for companies.' At the key making store, Singh provides a range of services related to keys and locks. They sell new lock and key pieces and sell old ones. They also fix bicycle locks and make copies of keys. Though he does not pay rent for his roadside stall, he pre-purchases materials he might need from the market. He purchases what he needs based on experience with what are common requests, but sometimes material does go to waste. This stall is his only source of income.

Singh and his family live hand-to-mouth on the earnings from his stall, around 500 rupees a day. He receives anywhere between 2 to 10 clients in a day. This is just enough to cover food, his three children's basic expenses and usually rent, but little else. Because of this, Singh works every day of the week, 12 hours a day, and rarely takes holidays. Rent in Delhi is expensive - around 5000 rupees per month for the small apartment his family lives in. 'If I can get support to pay the rent, it would be one major stress off my shoulders.' The amount of work does not vary much throughout the year. Even during monsoon, Singh answers calls from his customers and continues working.

Expense/Income	Item	Amount per month
Income	Key making stall	15,000
Expense	Household rent	(5000)
Expense	Materials	(3000)
Expense	Children and household expenses	(6000)
Total Remaining		***1000***

Singh's greatest impediment to expanding his business is lack of security to take up a loan to invest in new machines and rent out a small shop. He does not own a home, a car or a store. One machine can cost 1.5 lakh rupees. Machines would expand the range of services he can provide, and increase the pace at which he can complete his work. 'Right now we do everything by hand. It is very slow; it takes us 30-45 minutes to cut a lock, which someone with a machine can do in 5 minutes. We can only do small jobs – padlocks, bike locks and those sorts of things. With machines, we will be able to do bigger jobs like car locks. We can get more business.' Lack of funds also means he does not have the resources to advertise his services. Overall, he estimates he would need about 2-3 lakh rupees to start up a shop with a wider range of services. He is also concerned that due to his lack of education he won't know for sure if someone is giving him a good or bad deal on the loan, and won't be able to understand how the repayments would change over time.

Singh says that he is lucky that he has long-term, loyal customers. Because of them, his earnings, compared to his expenses, have largely remained the same over the course of his life. However, he rarely gets new customers now, as they are more likely to go to the key makers with a permanent storefront. There does not appear to be a future for key making for those who cannot afford to set up a formal store and provide a wider range of services. He doesn't know anyone who has been able to start with a roadside stall and set up a permanent store front. In fact, other key makers are leaving the profession and setting up other businesses, such as roadside food stalls or taking up work with larger, existing key maker stores. But for Singh, this is all he knows.

3. Mohammad Javed – Pressure Cooker Repairer

Name: Mohammad Javed

Age: 35

Occupation: Appliance Repairer

Education: 6th standard from his home village near Meerut

Mohammad has been running his repair shop in New Friends Colony, New Delhi, for the past 10 years after moving from his village in Uttar Pradesh. He repairs a range of household appliances, including pans, sewing machines, pressure cookers and blenders. He purchases all the parts he may need from Sadar Bazaar and stores them in his shop. All repair work is done by hand using hand tools such as spanners, saws and screwdrivers.

Mohammad moved to Delhi because there was no opportunity for agricultural work due to poor land quality and lack of funds to purchase land in his village. He is originally from a village close to Meerut, Uttar Pradesh. In Delhi he works long hours, often 14 hours a day from 9am to 11pm. He has to work this long to make enough money to meet expenses. Mohammad commutes about 10 minutes each way to the shop by cycle. He and his family, consisting of his wife and three children aged 2, 10 and 14 years old, live in a small two-room rented flat in Zakir Nagar. Mohammad's four other brothers are also in the repair business, two of whom are in Delhi as well.

Mohammad receives on average between 2-5 customers every day and earns around 500 rupees. He earns more in the summer, up to about 700 rupees per day on a good day, with often up to 10 customers, but this goes down to an average of 300 rupees per day in winter with as low as 2-3 customers. More appliances break down during the summer as they are used more, such as pressure cookers and blenders, due to more heat and power outages. He pays a rent of 5000 rupees per month for the shop, and 3000 rupees for the house. Parts cost an additional 1000-3000 rupees per month depending on the season and demand. The monthly cost of electricity is about 200 rupees in winter, and 700 rupees in summer when he uses the fan. Heals receives 1800 rupees every 6 months for sending his children to school and to cover uniform and book costs. Overall, after his children's expenses (such and food and private tuition) and rent, he has anything between 0-3000 rupees left each month depending on the season. See the tables below for illustration.

Winter

Expense/Income	Item	Average amount (rupees)
Expense	Shop rent	(5000)
	House rent	(3000)
	Parts	(1000)
	Electricity	(200)
Income	Children support from government	300
	Shop work	9000
Total		*0*

Summer

Expense/Income	Item	Average amount (rupees)
Expense	Shop rent	(5000)
	House rent	(3000)
	Parts	(3000)
	Electricity	(700)
Income	Children support from government	300
	Shop work	15,000
Total		*3,300*

Most of his customers are locals who are already aware of his shop being there, or walk by and see it. His shop is on a street parallel to a main pedestrian route, and can be seen across a *nala*.

Mohammad learned the skills by working for other repairers in New Delhi when he first moved 15 years ago. He did this for 4 years before he decided to open his own shop to earn more money. Mohammad said that when he first started his shop, he could get the same number of customers within 7-8 hours. Back then, he would also average 500 rupees a day in earnings. However, the number of customers is reducing as people's habits are changing. 'People now prefer to purchase new products when appliances break down rather than get them repaired. They think why spend 100-200rupees on repair when they can get a new appliance for 800 rupees.' He was earlier in a more visible location on a cleaner road nearby, but his previous landlord removed him from that location 5 years ago when a higher payer came along. He said, "Earlier, people used to see my shop and come. Now, I have this dirty nala in front of my store, and the store is at some distance from

the main path."Both of these things have meant that the number of customers has decreased in the past 5 years.

Mohammad goes back to his village to visit his parents once a month for 2 to 3 days, and also to attend family events. He rarely takes public holidays off as this would impact his income.

Mohammad's greatest challenge is his health. He often experiences pain in his body. He has previously gone to a hospital where he was referred multiple tests, which would cost around 10,000 rupees all together. He is unable to afford these without forgoing meals for his children, so instead he takes painkillers on a daily basis from the local doctor. These cost him about 50 rupees a week.

Another challenge is many of the parts he purchases need to be original, or they would not work in the appliances. As they are original, he must pay GST on them. These parts include pan handles and cooker whistles. The use of these parts has become expensive and reduces his profit margin by 5-10 rupees depending on the service. Despite him using original parts, people expect cheap prices for his services and so he isn't always able to compensate for this higher cost fully.

Mohammad's dream is to start selling new products to his customers and to other smaller shops nearby as a wholesaler. For this, he would need to invest around 4-5 lakh rupees to purchase new products and expand his shop. Once his children have finished their education and can support themselves, he is hoping he can save up to do this or work with his children. He is not interested in a loan, as paying interest is not allowed in his faith. Another option is to move back to his village and start buffalo farming. This would also require investment. However, he would like to stay in Delhi at least until his children grow up, as here they are able to receive a quality education for free. They study in a public school in Zakir Nagar.

4. Dayali Ram – Cobbler

Name: Dayali Ram

Age: 65

Education: 4th Standard

Occupation: Cobbler

Dayali Ram runs a shoe repair shop in Old Pillanji Village, Kotla, New Delhi. At his enclosed shop, Dayali Ram provides a range of services related to the creation and maintenance of shoes, including making shoes, repairing shoe leather and soles, providing new laces, providing insoles and polishing. While he repairs shoes for both genders, he only sells new shoes for men. This is because it is possible to make men's shoes by hand and without machines. Dayali has been working in this shop and service for his whole life over the past 40 years, and this is the only skill he knows. He has hired two shop boys who help him with his work.

Dayali Ram moved here from his home town in Rajastan 40 years ago to find work. He worked as an apprentice for a relative also from Rajasthan for a year before he opened his own store.

Dayali Ram used to own Karigar machines to make and repair shoes, but stopped using machines about 10 years ago because they were too expensive to purchase, at over 1.5 lakh. If he were to purchase a new machine, he would have to increase his leather shoe prices to 1500 to cover for the cost of the machine, and cheaper leather shoes are available from factories in Agra at around 500 rupees per pair. He would not be able to compete with these prices. Therefore, he only now makes new shoes and sandals from cloth, and not leather.
Dayali Ram generally works 14 hour days from 7am to 9pm and only takes days off on major festivals and family events such as weddings. Most weeks he works 7 days. He travels to and from his home in DabriMor by bus, which takes him over two hours each way and costs him 600 rupees a year.

Dayali Ram pays 7000 rupees per month in rent for his shop, and purchases all materials from the local market. These cost about 2000-3000 rupees per month. Dayali Ram was not comfortable disclosing his exact daily income, but overall he is content with his earning. He earns enough to eat comfortably and support his family. All four of his sons went to school until 12th standard in public schools in Delhi, and are now married.

Dayali Ram currently receives between 5-7 customers per day. Most of his costumers are repeat customers from the local area who have known him throughout his life. He gets more business during the winter season than summer and monsoons, up to 10-12 customers per day, as people wear shoes rather than sandals due to the cold. Sandals, worn in summer, are cheaper to replace or easier to repair at home. Also, people don't wear new shoes in the monsoon as they get ruined, and they wait until after the monsoon season to get them repaired.

Overall, the number of customers is decreasing, and no one is joining this profession anymore. People are more interested in purchasing readymade shoes than getting repairing their old shoes repaired, as it is not much more expensive. This is especially the trend in the younger generation. Dayali Ram's children are not working in this profession as they see no future in it. They are instead working as professionals in companies. As he is old, Dayali Ram thinks he can keep working as he needs some income while he ages. It is enough for him.

Dayali Ram has had some negative experiences with fake loan companies. Twice in the past 10 years, people have come offering loans, have taken around 3000 rupees as collateral to set up the loan, and never returned. He was hoping to use the loans to purchase a store rather than rent one. Another challenge is that even though his health is sometimes poor now, as he suffers from back or knee pain, he needs to keep working to meet daily household expenses. He goes to the local doctor and receives pain medication to manage the pain. He does not think he can afford going to a hospital, so he hasn't visited one recently.

Winter

Expense/Income	Item	Average amount (rupees)
Expense	Shop rent	(5000)
	House rent	(3000)
	Parts	(1000)
	Electricity	(200)
Income	Children support from government	300
	Shop work	9000
Total		*0*

Summer

Expense/Income	Item	Average amount (rupees)
Expense	Shop rent	(5000)
	House rent	(3000)
	Parts	(3000)
	Electricity	(700)
Income	Children support from government	300
	Shop work	15,000
Total		*3,300*

Most of his customers are locals who are already aware of his shop being there, or walk by and see it. His shop is on a street parallel to a main pedestrian route, and can be seen across a *nala*.

5. Hazmuddin Safi – Scissors Repairer

Name: Hazmuddin Safi

Age: 55 years

Education: Not Literate

Occupation: Scissors Repairer

Hazmuddin Safi runs a scissor repair business in Shakurpur Village since the past 28 years and this is the only skill he knows. At his enclosed shop, he provides a range of services related to the creation and maintenance of scissors. Safi works for 10-12 hours per day from 10am to 8pm except Sundays. He has hired a boy who helps him with his work.

He lives in a small house in Sultanpuri with his family which is 15 minutes away from his work place.

Safi and his family live hand-to-mouth on the earnings from his shop which are around 100-200 rupees per day. He receives anywhere between 1 to 4 clients in a day and charges 50-100 rupees depending upon the work. It is very difficult for him to cover food, his two children's basic expenses, shop rent and helper's salary.

Rent in Delhi is so expensive, around 5000 rupees per month for the small house his family lives in. He stated, 'If I can get support to pay the house and shop rent, it would be one major stress off my shoulders.'

This costs about 2000-3000 rupees per month. He was not comfortable disclosing his exact daily income, but overall he is not at all satisfied with his earning.

Safi also stressed upon the fact that the number of customers is reducing day by day, and no one is joining this profession anymore. People are more interested in purchasing readymade scissors than getting them repaired. This is especially the trend in the younger generation.

There does not appear to be a future in scissor repairing for those who cannot afford to set up a formal store and provide a wider range of services. He doesn't know anyone who started with a roadside stall and has been able to set up a permanent store front. In fact, other repairers are leaving the profession and setting up other businesses because the machine runs on electricity and

it costs them daily. Earlier, his shop used to be so crowded that people could not get space to step in, but now there are rarely any customer he interacts with. Despite this long-standing tradition, Safi is determined that his children do not follow in his footsteps. 'This work isn't great…my hope for them is that they study hard and go work for companies.'

He ended up by saying that he will soon shut down his business.

6. Abdul Gaffar – Key maker

Name: Abdul Gaffar

Age: 40 years old

Education: 10th standard from a public school in Dadri

Occupation: Key maker

Since the last 18 years, Abdul sets up his key making shop every day at 9am, on a main road of sector 10, Noida. Before this, he used to set up his shop in Dadri for about 10 years. He is originally from Dadri, a town in the Gautam Buddh Nagar district of Uttar Pradesh. This is his ancestral work since the last 100 years.

When he was a child, Abdul used to go to school from 7am to 1pm, and after that he used to learn the skill of key making at his father's shop. He said the most important skill in the key making business is an eye for detail. A perfect eyesight is needed to work in this field.

He has 6 children, 2 girls and 4 boys. 3 of the children have passed 10th standard from a government school. Abdul said he would never allow his children to do this work, they hadn't even seen his shop. He wants them to study hard and get a job in some company and earn a regular income.

Abdul works for 12 hour a day, 9 to 9, 7 days a week and takes just about 10-12 days off in a year due to illness or to attend a family function. He doesn't use any kind of machine to make keys or repair locks, but uses various types of manual tools to do his job. The tools include a hammer, file, screwdriver, small metal piece which he uses as an anvil, chheni, summi, etc.

Abdul gets about 10-15 customers per day, mostly to buy new locks instead of getting anything old repaired. This is the reason he gave when asked why it was so difficult to find key makers these days. Earlier, the customers came with their old locks to get them repaired or to get a duplicate key for them, but now they just prefer to buy new locks. He is able to earn about 300-400 rupees per day.

Expense/Income	Item	Amount per month
Income	Key making stall	12,000-13,000
Expense	Household rent	(3500)
Expense	Materials	(2500)
Expense	Children and household expenses	(6000)
Total Remaining		***0-1000***

He says the income has dropped and the expenses have increased in the last 10 years. A lock which used to cost him about 25 rupees, and which was sold for about 45-50 rupees now costs him more than 35 rupees because of GST. He recalls paying 100 rupees as house tax, but now he has to pay 2300 for the same.

He says, the government should provide them with a small shop to operate. '50 rupya sarkar ko bhi de sakte hain agar 100 kamayenge.'

7. Mohd. Khalid – Key maker

Name: Mohd. Khalid

Age: 38 years old

Education: 8th standard from a public school in Babugarh, Hapur.

Occupation: Key maker

Mohd. Khalid is a key maker who lives in Noida and runs a shop by the roadside in sector 10. Since he has been working here since last 26 years, he has seen the change in the city from when it was more of a village with mostly farms around it to a city with so many high-rise buildings in it. He is originally from a town called Baburgarh in Hapur district.

Khalid's family has been in this profession since years, passing on the skills from one generation to another, but he doesn't want any of his children to learn and do this work; he wants to educate them and let them decide their fate. He has 10 children - 3 boys and 7 girls. 6 of them go to school and the other 4 are not yet old enough to join the school. His wife works as a domestic help.

Khalid opens his shop at around 10am and wraps up by 9pm. He sits on a plastic chatai (mat), places a vertical ply board with various kinds of locks that are available with him. He makes duplicate keys, repairs old locks and sells new locks. Earlier, he used to make keys for cars too, but doesn't anymore as he feels that the car locks are too complicated. He uses a hammer, file, screwdriver, chheni, summi, small metal piece which he uses as an anvil, etc.

He gets about 15-20 customers per day and earn about 300-400 rupees per day. Sometimes, he has to go to people's homes to make a duplicate key when the original has been misplaced, which is when he gets paid the most, but this happens very rarely.

Expense/Income	Item	Amount per month
Income	Key making stall	14,000-15,000
Expense	Household rent	(4000)
Expense	Materials	(3000)
Expense	Children and household expenses	(8000)
Total Remaining		***0***

He says, ‘Now, people don’t come to us to get their locks repaired or to get duplicate keys, but they come mostly to buy new locks, as that’s much faster and easier for them. Due to the surge of complicated locks and the internet, these days people don’t even have to come to us, as they can get everything online at their doorsteps for which they are ready to pay a much higher price, but when they buy from us, they always try and bargain.’

The skills he has learnt over his lifetime are slowly dying.. He says, ‘We have done this all our lives, we don’t have any other skill, who will give us work? I will do this work until my eyesight is good enough; after that I’ll just sit at home and hope that my children will take care of me.’

8. Lala Ram – Cobbler

Name: Lala Ram

Age: 62

Education: 5th Standard

Occupation: Cobbler

Lala Ram runs a shoe repair shop under a tree in sector 9, Noida. He repairs and polishes shoes, slippers, sandals, etc. He has been working as a cobbler since 1985, before which he worked as a daily wage labourer.

Lala Ram is originally from Harkanpura, a village in Tikamgarh district in Madhya Pradesh. He moved to NCR in 1990s with his wife, 2 daughters and a son. Both the daughters are married now and the son is into this repair work only.

Lala Ram generally works for 11-12 hours a day from 8am to 7pm, and only takes days off for major festivals and family events such as weddings. He lives in a room on rent nearby in sector-4, Noida.

He currently receives between 10-20 customers per day. These are mostly men who want to get their shoes polished in the morning. The women come mostly in the afternoon after completing their daily chores. He senses a slight increase in customers during winter season as shoes are worn on the daily basis and because of the cold the footwear tends to harden and develop cracks.

He has various tools and other things which help him to repair/polish the footwear. Scissors, pliers, long and thick needles, threads of different shades, hammer, cobbler's anvil, small nails, polish of different shades, and brushes with soft and hard bristles are some of the tools he uses.

Expense/Income	Item	Amount per month
Income	Shoe repair shop	15,000
Expense	Household rent	(6000)
Expense	Materials	(3000)
Expense	Household expenses	(4000)
Total Remaining		***2000***

Lala Ram feels that no one prefers to join this profession anymore. People get paid more in a factory for working for the same amount of time. Moreover, people are more interested in purchasing new footwear than getting it repaired. The factories are mass producing them at a much lower cost. His son will be the last person in his family who will work as a cobbler. Lala Ram says he will work till his body allows, and after that he will just rest on a 'chaarpai' and smoke hookah in his village.

9. Mahesh -Electrician

Name: Mahesh

Age: 34 years old

Education: 12th Standard

Place: Sunpura (Village in Uttar Pradesh)

Occupation: Electrician

Mahesh works as an electrician in Sharda University. His designation is RO Supervisor. He also works temporarily as an electrician on call bases. His wife also supports him with the household income. She works in a private company. They both have 3 children: a daughter, age 16, is studying in class 10, and two sons, ages 12 and 8, studying in class 7 and class 4respectively.

In his native place he used, to work as a milk vendor but due to lack of profit margin, he was forced to look for an alternative.

Mahesh and his family, moved to Shaheed Nagar, Ghaziabad in search of work and now after 10 years they are well settled but in a rented home. Earlier, people of that area used to discard their electrical appliances due to lack of a skilled technician to repair them, but now since Mahesh is in that area, he is able to repair them for continued use.

Expense/Income	Item	Average amount (rupees)
Expense	House rent	3000
	Shop rent	4000
	Electricity	1000
	Household expenses	2000
Income	Job &Repair work	15,000 + 5,000
Total		**10,000**

Mahesh is a skilled labourer and he also guides other residents that instead of discarding their appliances in a dumping yard, they should first try to get them repaired. Most material used in the products cannot be recycled. He also spreads the awareness that before purchasing any electrical appliance, people should check if the product can be recycled or not.

Mahesh shifted to Delhi on the advice of his brother. Now after 10 years he feels glad that he took that decision. Earlier, he started working in a private company as an electrician, but later on because of his friendly behaviour he was able to build strong relationship in the area and very soon got the promotion.

10. Malkanj Singh – Cobbler

Name: Malkanj Singh

Age: 50 years

Education: Not Literate

Occupation: Cobbler

Malkanj Singh runs a shoe repair business in Pitampura near Harsh Vihar chowk in Delhi. He sits on the pavement and provides a range of services related to the creation and maintenance of shoes, including making shoes, repairing soles, providing new laces, insoles and polishing. Singh has been working since the past 12 years, and this is the only skill he knows.

Malkanj Singh generally works 10 hour days from 9:30 am to 7:30 pm and only takes days off when needs to travel to his village. During most weeks, he works 7 days.

Singh pays 3000 rupees per month as rent for his house and he manages to make 10,000 rupees per month, so he saves around 4000 per month excluding other expenses. He has two daughters and both are married, hence he is working just to feed himself. He lives alone in Shakurpur village which is very near his work place, so this saves his travelling expense also. Hence, he is satisfied with his earning. He earns enough to eat comfortably and manage his basic needs.

Currently, Malkanj Singh attends to 15-20 customers per day. Most of his customers are repeat customers from the local area who have known him throughout his life. He gets more business during the winter season than summer and monsoons - up to 25-30 customers per day - as people wear shoes rather than sandals due to the cold. Sandals, worn in summer, are cheaper to replace or easier to repair at home. Also, people don't wear new shoes in the monsoon as they get ruined, and they wait until after the monsoon season to get them repaired. He also mentioned that people do not get their footwear repaired because it is expensive. His biggest challenge is to work during the monsoon season because he works under a canvas made up of some ply woods and flex and his repairing equipment and shoes get destroyed. Also, in winters he works under a street light for long hours since there is no electric connection.

11. Megha – Rafoogar, cloth repairer

Name: Megha

Age: 28 years old

Education: 7th standard

Occupation: Alters clothes, Rafoogaar

Megha runs an alteration business in Lok Vihar, PitamPura for the past 3 years. She works under a tree from 11am to 6 pm for 6 days except on Sundays. Prior to her current venture, she was a cook for 7 years. but due to recurrent medical issues, her health does not allow her to work for long hours, and she finds this work to be more liberal and suited to her time.

Megha got married at the age of 15 and has 2 children - 1 boy and 1 girl of 3 years and 6 years respectively. They both go to a government school for education. Her husband is unemployed and does not contribute in the day to day expenditure. For this reason, her in-laws have separated them, and currently, she is the only breadwinner in the family. One of the challenges is to commute 30 km daily via 3 buses from a village in Kanjhawala to Pitampura because of dearth job opportunities there, which costs her around 50 rupees a day.

She works for 6-7 hours a day, interacting with 2-5 customers and earns around 250-400 rupees a day. She found it very difficult at first because she did not know how to stitch. In fact, she hated stitching, but the financial situation at the home front forced her to do so. Her brother taught her stitching and she finally started her venture.

When she started, people did not even allow her to sit opposite or near their homes on a pavement because they feel inferior. After negotiations with the people around the area, she somehow found a place to work from.

Sitting alone under a trees' shade in the scorching May-June heat with hot water to drink resulted in low blood pressure. Few days ago, she had to stand for 2-3 hours because of a dust storm and rain since there was no place where she could get shelter. She also complained that her customers didn't understand her situation regarding the issue of space for keeping their clothes. They forgot

to collect their clothes and this resulted in her loss. She called them twice but they are least bothered and calling costs her 2-3 rupees so her overall earning is decreased.

She also mentioned that there was no income generation in winters and she cannot work in the rainy season. Summer is her only time when she earns some amount, but that too is difficult under tree's shade. This is her biggest challenge.

Summer

Expense/Income	Item	Average amount (rupees)
Expense		
	House rent	(2000)
	Others	(500)
	Electricity	(500)
Income	Children support from government	300
	Shop Work	5,000
Total		*2,300*

She has requested to lend her an enclosed shop because it's very difficult to survive. Most of her customers are locals who are already aware of her place being there, or walk by and see it.

After leaving at 6, she wish if she gets a glass of water after reaching but nobody is there to help her out. She says regretfully 'Kaash maine padhayi kar ki hoti, to aise din nahin dekhne padhte.'

12. Mohammad Aadil Khan – Pressure Cooker Repairer

Name: Mohammad Aadil Khan

Age: 33 years old

Education: 6th Standard, from his village near Meerut

Occupation: Appliance repairer

Mohammad runs a mobile appliance repair business in Lajpat Nagar area. He carries his repair instruments and parts on the back of his motorbike, which he uses to visit people's homes and repair appliances. The appliances he repairs include pressure cookers, stoves, blenders, sewing machines and microwaves. He currently lives in a single ground-floor house in New Friends Colony in with his wife and children.

Mohammad is originally from a village near Meerut, but he moved to Delhi 20 years ago when his family decided to move here for work. Three of his other brothers also work in this profession, but they all have their own stores in different areas in Delhi.

His primary motivation for working is to support his volunteering work. He seeks to provide enough money for his family to live on, so that the rest of the time he can volunteer with a local mosque working with people with alcohol addiction. He volunteers in this programme 3 days per month, and often takes 2-4 months off in the year to travel to different parts of India and the world to implement this program.

Mohammad has been working in the Lajpat Nagar area since he started his mobile repair business 10 years ago. Before that, he ran a cloth store where he created embroidered Chikan fabric and garments. However, this was not that lucrative. His friend then suggested that he learn this repair work from him. Mohammad worked with his friend for 3 months for free to learn the trade before starting on his own. Initially, he rode around on a cycle, but was able to save up within two years and purchase a moped with help from an interest-free loan. He later purchased his motorbike in a similar manner.

Initially, due to longer travel hours on the cycle, and the inability to carry a large range of parts, he earned only around 200 rupees per day. However, his income increased as he purchased vehicles

where he could carry more parts, and hence service a greater variety of appliances and see more customers in a day.

Most of his current customers are repeat customers who know him from the area. He also hands out business cards to people moving into the area, and others who ask him for information on his services. He also has his contact details advertised on the side of his bike for potential customers to obtain.

On an average, Mohammad spends about 6-7 hours per day commuting in Lajpat Nagar. He starts on his rounds at 9am and finishes by 3 or 4pm. If a customer calls after these hours, he attends those jobs. Other than his three volunteering days, he also takes days off for festivals and family events. This usually averages to an additional 1-2 days a month.

Mohammad's business revenue is highly variable – on some days he gets no customers, while on other days, he receives up to 6 or 7. On an average, he earns around 600 rupees a day (about 15,000 per month), but this amount again varies greatly depending on the type of repair work he receives and the number of customers. For example, last month he earned 3000 rupees in one day when he repaired five stoves in an apartment complex, in addition to his usual customers.

Typical month income and expenses

Expense/Income	Item	Average amount (rupees)
Expense	House rent	(2000)
	Parts	(5000)
	Petrol	(1000)
	Household expenses	(3000)
Income	Repair work	15,000
Total		***4000***

Mohammad continues to work during the monsoon season. However, on days that the weather is especially bad, he is unable to travel on his bike. This means that his average earnings during the monsoon are lower, at around 10,000 rupees per month. He also has fewer customers in the monsoon season as more frequent power outages means that customers use their appliances less, and thus, less repair is required.

Mohammad as three children - a son aged 7 years old and two daughters aged 3 years and 4 months. The 7-year old son attends the local public school.

Mohammad saves the remaining money from his earnings to support himself and his family when he leaves for his volunteer work. His parents live nearby, and the families also support each other and often share meals together. If he is not able to cover the full cost of his volunteering himself, he takes an interest-free loan from one of his relatives or friends at the mosque. His wife is adept at managing household expenses on the low budget of 3000 rupees per month as she understands the rest is required for his volunteer work. His wife lives simply and does not expect expensive clothing or gifts.

Mohammad believes that his work will continue as it is. He believes that God has a plan for him, and whatever happens in the future is His will. Therefore, he doesn't think too much of the future and will deal with challenges when they come. For now, he is able to earn what is needed. He believes that he has an advantage over others as he is able to travel to people's homes for repair work and is hence able to charge more, and he does not need to pay shop rent. Overall, as for the profession, he believes it is more difficult to enter than it was previously, as there are many people working as repairers and many of them already have loyal customers. The work is also unlikely to grow as appliances are becoming cheaper to purchase, so people would rather purchase new ones than are get the old ones repaired.

Mohammad has considered expanding his business by having a partner who is willing to put in funds. By doing this, he would be able to purchase a larger vehicle, such as a van, and service larger appliances such as washing machines. However, he thinks it would be very difficult to find someone who would be willing to collaborate with him, given that he travels for his volunteer work frequently. He would be expected to meet certain revenue targets, and he prefers his current levels of freedom.

13. Raju Verma- Cloth Alteration

Name: Raju Verma

Age: 60

Education: 10th standard

Occupation: Cloth Alteration business

Raju Verma sits in front of a grocery store, right at the corner and usually has a pile of clothes around him which the customers give him on a day to day basis. Since he is located on the main road, as someone who is involved in alteration, people can locate him easily. Originally from Nepal, he came to Delhi with his family in 1971, when he was 12 years old. He has been in this profession since the last 40 years. He currently lives in Delhi with his wife near ShaadiPur and has 3 kids. One of his daughters is married; his son works in the private sector and his other daughter is studying in college.

Things were not this difficult for Raju around 10 years ago. He was the owner of a cloth shop which was situated in the market and earned fairly well. 6 years ago, he met with an accident and injured his leg, and a botched-up diagnosis made the injury permanent. As business declined, he was forced to close down his shop and open an alteration business/kiosk right at the corner of the market.

Since he had already worked in the same sector, the only investment he made was finding a suitable spot for people to find him and become his customers. Other instruments like the sewing machine,

Expense/Income	Item	Average amount (rupees)
Expense		
	Business investments and machine maintenance	2000
	Others	500
	Electricity	500

which was bought for 10000 rupees and its maintenance were carried from his previous job.

Income	Cloth Alteration venture	8,000
Total		5,000

Investments in sewing kits and thread are a recurring cost that he has to replenish for his venture to flourish. He is able to cater to 5-6 customers per day earning around 5000-8000 rupees a month, and since he had a cloth shop earlier, some of his old customers also come to him from time to time, for any kind of cloth alteration.

Raju's day starts from 11amand he works till 10pm. He hardly takes any holidays except for important festivals, and also does not fall sick that often to take an off from his work. His family was also involved in doing a similar work back in their hometown, and his elder brother and sister taught him the basics about the profession. Now, with his family being so far away from him, he admits that no one is involved in this business other than him.

Working in this field for so long, he has realized that there is no particular season/time wherein there are more customers than normal, and that his business depends upon people's demands to repair/alter their clothes. He also remembers the time when more customers came to him because readymade clothes were expensive and hard to find. Now days, people who are investing in fast fashion and western clothes do not see any reason to engage with people like him.

The biggest challenge that he faces is regarding a proper place to sit to continue his business. Due to the injury in his leg, he also requires help from the government in the form of loans to pay off his debts and pay rent for the new place. When asked about the future of his profession, he seems very hopeful as people would continue to buy clothes, and that he will be able to carve out a living for himself in this profession.

14. Rohtash - Cobbler

Name: Rohtash

Age: 65

Education: 8th standard

Occupation: Cobbler

Tucked under the shade of a makeshift arrangement, Rohtash sits reading a newspaper, waiting for the customers to show up. He has been in this profession for the last 30 years. Originally from a village near Rewadi, Rohtash never thought of learning this trade. In his childhood, he was as carefree about the world as any other teenager in the world. He came to Delhi in 1973, and learnt the technique of shoe repairing from his father. After his father passed away, he learnt the tricks of the trade from his elder brother. Today, Rohtash lives in Baljeet Nagar, near Patel Nagar with his 2 sons and their families. He also has a daughter, who is now married. He has three grandchildren who live with him and the eldest granddaughter attends school.

His day starts at 8am and goes on till 8pm. In his 30 years of work, he has not been able to expand his skill to making shoes and sandals, and only knows the technique and methods of repairing them. Apart from shoe repairing, he also manages to repair leather bags and belts, as well as sew cloth bags for reuse.

When he started this work, he borrowed the instruments required from his father and brother, since they had helped him learn the work and get started. Later, when he set up his shop, he bought his own instruments from Moti Nagar. He has been using the same set of instruments for the last 20 years. When asked about the difference of buying the instruments today and in the earlier days, he expressed his disappointment on the increasing prices. Earlier, a simple thread roll for sewing shoes used to cost much less as compared to now, when it is difficult to buy thread rolls and other things required by the cobbler.

On a typical working day, he gets around 15-20 customers a day who ask him to do a range of work such as changing the sole of the shoe, sewing a bag or sandals and some pasting and repairing work. He is able to earn anywhere between 500-700 rupees per day. Since his shop is right on the main road, he is able to get 15-20 customers per day. He has been able to distinguish a pattern, wherein between the start of new season, people come to him for repairing shoes and sandals, and sometimes, winter boots as well.

Expense/Income	Item	Average amount (rupees) in a month
Expense		
	Buying new threads and maintenance for the instruments	2000
	Others	2000
	Electricity and water bill	1000
Income		
	Shop Work	15,000
Total		*10,000*

In his family, 2 of his sons are educated, while the youngest son works in a factory to sustain the family. Rohtash's income is enough to sustain his livelihood, a constant which he has had since the last 30 years. He seldom takes holidays, except for festivals like Dussehra, Diwali etc.

When asked about the biggest challenge is his life regarding his profession, he is uncertain about the future prospects. He certainly does not want any member of his family to get involved in this profession, citing that the there is no money or respectability in it.

15. Sati Singh - Key Repairer

Name: Sati Singh

Age: 50 years old

Education: 5th standard

Occupation: Key Repairer

Sati Singh has been repairing keys in Rani Bagh Market for the past 30 years. He lives in Narela and travels 10-15 km by bus. He works on a pavement from 10am to 8pm. At the key making store, Singh provides a range of services related to keys and locks. He sells new and old locks and keys. His whole family has been in this profession since the past 20 years in different areas i.e. Connaught Place, Rani Bagh and Harsh Vihar.

Singh and his extended family are blessed with 13 children and find it difficult to meet their basic needs. They try to make 300-400rupees a day at one place. Singh attends to anywhere between 5 to 8 customers in a day. This has reduced as people prefer keys made from machines because they are much better compared to the ones made manually. The income is just enough to cover food, his four children's basic expenses and usually rent. Because of this, Singh works every day of the week, 10 hours a day, and hardly takes any days off.

Singh wants to expand his business but has lack of security to obtain a loan to invest in new machines and take a small shop on rent because it is very difficult to carry equipment during the summer. He repairs keys manually because he can't afford to purchase basic machines which cost around 30,000-50,000 rupees. So, he first creates tools manually to repair keys.

Machines would expand the range of services he can provide, and increase the pace of the work. Currently, everything is done by hand. This process is very slow; it takes about 40-50 minutes to cut a lock, which someone with a machine can do in 5 minutes. He can only do small jobs – padlocks, bike locks and related things. With machines, he would be able to do bigger jobs like car locks. Lack of funds also means Singh does not have the resources to advertise his services. His biggest challenge is to pay house rent and meet his children's needs.

He further mentioned that the amount of work does not vary much throughout the year. Even during monsoon, Singh tries to answers calls from his customers and continue working.

Expense/Income	Item	Amount per month
Income	Key making stall	12,000
Expense	Household rent	(4000)
Expense	Materials	(2000)
Expense	Children and household expenses	(5000)
Total Remaining		***1000***

He ended up by saying that there is no future for key-making and repairing for those who cannot afford to set up a formal store and provide a wider range of services. In fact, other key-makers are leaving the profession and setting up other businesses, such as roadside food stalls or taking up work with larger, existing key-making stores.

16. Shivdaani Ram – Cycle rickshaw repairer

Name: Shivdaani Ram

Age: 45 years old

Education: 5th standard from a school in Patna.

Occupation: Cycle Rickshaw Repairer

Shivdaani Ram works as a cycle rickshaw repairer in Peer colony in the Sahibabad Industrial Area. His family is from Munger, Patna. He shifted to Sahibabad with his family 9 years ago and has been living there since then. Each day, he walks for approximately 20 minutes from his house to reach his 'khokha' (stall) where he repairs cycle rickshaws for a living. His stall is rented and is located on a road adjacent to the main pedestrian road, across an open sewer. He pays 2000 rupees a month as rent and spends another 1000 rupees a month on electricity to run his machines and fan. He works in his 'khokha' from 9am to 7pm awaiting customers. He takes Sundays and festival days off.

Shivdaani learned this skill from his older brother, who had previously worked in a repair shop in Patna. He was 18 years old when he learned the skill and has been doing this work since then. When he first started, he had a store near a busy road and since the location attracted a lot of customers, he earned well. At that time, he was earning 800-1000rupees a day on an average. There used to be a lot of cycle rickshaw drivers in that area, but now battery driven e-rickshaws have replaced cycle rickshaws and this has created a lot of problems for him. Government enforced sealing and upcoming constructions forced him to change location and that has worsened the situation. To accommodate with the changed location, he had to expand his work and include air-filling for bike and car tyres.

Shivdaani is very concerned about his future. The rapidly increasing cost of living is not in direct proportion to the increase in his earnings. According to him, he needs to find some more work as his family's needs are rapidly increasing. He is unable to expand his source of income any further. He doesn't earn enough to invest in further expansion of the business. Inconsistency in income makes it even more difficult as his work is directly affected by many external factors. He says some days he earns more than 800 rupees and some days are 'Nil batay sannata'. His current stall is cheaper than his previous location, but his earnings have also reduced considerably. He wants to own his own stall/store but hasn't been able to save up enough to make such a large investment.

His financial situation is not even allowing him to buy new instruments to replace the old, broken ones he has. He has been repairing the same old ones again and again, upon breakdown. In fact, he tries to repair the parts too, as it is cheaper when compared to replacing the parts with new ones.

Moreover, his earnings are not fixed, which makes everything so much more difficult for him. He says, 'I can't say how much I earn each month. Like I said, some days I get work, but many days I do not.' Summers are good for business as rickshaws compulsorily need repairing during hot days. On the other hand, as soon as the rains start, the work reduces.

Although, summers bring him good work, it is still a taxing job for him. Since his stall is very small, it becomes impossible to work inside and so he has to carry out all his work outdoor in the scorching sun. Some days he falls extremely sick due to the heat and the location is such that he doesn't even find clean water nearby.

When it gets windy, it becomes really difficult for his stall to stand still. His stall has suffered a lot of damage. Sometimes, the roof blows away and he has to empty his pockets for the repair work. The days where he falls sick are even worse, because each lost day costs him minimum 100-200 rupees. He is unable to spend money on his own treatment sometimes. Some days, customers do not pay upfront and to continue doing business with them, he has to let go of and ignore the unpaid amount.

Expense/Income	Item	Average amount (rupees)
Expense	House rent	3000
	Shop rent	2000
	Electricity	1000
	Household expenses	5000
Income	Repair work	10,000 to 20,000 monthly
Total		***0***

Shivdaani has three sons, aged 11, 9 and 7 years old. His youngest daughter is 6 and ahalf years old. The children study in a government school. None of his children want to continue with his line of work since they all know that this work doesn't pay much as compared to the effort it requires.

He feels that he does not have enough time left as his health is deteriorating rapidly. However, he feels that he will have to continue working and putting in more effort as he wants his children to be successful someday. His health doesn't permit him to work late nights. He is not at all physically fit, and yet he has to continue working in the scorching sun during summers. He has continuous pain in his knees, back and shoulders. He manages the pain with painkillers, treating himself at home as he cannot afford to go to hospital or consult a doctor. Whenever anyone in his family gets

sick, it becomes really difficult for him to consult a doctor. His financial situation is restricting him to fulfil even his daily needs.

At this age, he does not feel that he has the ability to learn a new skill. He has also never taken a loan in his life. He has always been afraid of the risk of taking a loan as he does not own any assets, and he is unsure if he would be able to make repayments. If he were to expand, it would require an investment of at least INR 4-5 lakh to purchase new machines and set up a larger store in a better area.

The main thing Shivdaani believes is that if government pays attention to lower income groups and releases some new job opportunities for people like him, it will help them to rebuild their lives. He believes he has no other option but to continue with this work, but he would be willing to work on projects for the government. There are fewer and fewer jobs these days in Delhi/NCR.

He would also greatly benefit from support that would help him either to pay his rent, or rent a better-located shop. His biggest stress over the past 20 years has been paying rent to property owners and the fear of unfair treatment at their hands.

17. Sonu Shekh – Bike Repairer

Name: Sonu Shekh

Age: 17

Education: 9th standard, New Delhi

Occupation: Bike repairer

Sonu is from Delhi and runs an open roadside bike repair stall in New Friends Colony along a main road. His store sits next to his father's key-making stall. Sonu left school after the 6th standard to help his father earn a living. He has two siblings who required care at the time, and his father was not able to meet expenses on his own. One of his siblings attends school, and his sister is married. Sonu helped contribute to his sister's wedding expenses.

Sonu's father set up the roadside key-making store 25 years ago, and Sonu joined him with the bike repair business one year ago after working for two years as an apprentice with a nearby bike repairer from whom he learned his skills. His services include repairing bike parts and bike locks, and he works manually to provide these services. He does not know much about his father's key-making work. He does not feel the need to learn those skills as he is able to make his contribution with the bike repair work.

Between the two stalls, the pair make on average 800 rupees a day. In the summer and monsoon seasons, Sonu gets about 5-7 customers at his stall, and makes about 400 rupees. Most customers are ride-by customers who spot the store. There are a few regular customers. The number of customers often reduces in the winter season due to fewer bike-related issues, and in particular, fewer wheel punctures. During winter, he only makes about 200 to300 rupees from his bike repair business.

Sonu takes holidays only on public holidays and festivals, but often works 7-day weeks. He is at his stall from 9am in the morning to 7pm in the evening.

Sonu does not pay rent for his roadside stall. He has set up a temporary tarpaulin cover on wooden sticks over his stall to protect himself from rain and sun. His main expenses are tools and parts. His latest purchase of second-hand tools from the market cost him 6500 rupees, but these should last him about 2-3 years. He also regularly purchases parts, which cost about half of what he charges for his services. He also contributes to his home's rent, which is 2500 rupees per month. His home is just a 10-minute walk from his stall.

Sonu sees himself working in this profession in the future. He enjoys the work and the social setting around his stall, where a range of other informal stallholders sit. 'I am happy here. I like this work, and I like my friends being around.'

One fear that Sonu has is that because his stall is not legal, and is located on the side of the road, the police will one day come and destroy his equipment and make him leave. This has happened in the area several times about 5 years ago. He says, 'The police used to come sometimes and remove all the shops form here. The other stallholders would then have to find somewhere else to set up. Sometimes they broke things.' He hopes for some licensing system to be introduced to protect roadside stallholders from harassment and loss of property. He does not have the funds to go anywhere else or set up the stall again if his materials get destroyed.

18. Sucha Singh – Key Maker

Name: Sucha Singh

Age: 34 years old

Education: 10th standard

Occupation: Key Maker

Sucha Singh sets up his stall 10 metres away from Dashrathpuri Metro Station. His stall has locks hanging in the front with his tools placed on the side. He resides in Sonipat and commutes to Delhi for work almost every day. He is a jolly sikh and has been working as a key maker since the past 18-19 years. His job includes fixing old locks, making duplicate keys for almirahs, bikes and cars. He requires a hammer, chisel, glass, "summi", steel filer, pliers, nut bolts, etc. and he manages to purchase these tools from Adarshnagar, Delhi. Singh dedicates 5-6 hours for work. He usually works everyday but he takes a holiday in case of emergency. Depending on the type of work, he charges a minimum of 30 rupees to a maximum of 300 rupees from his customers.

For Sucha Singh, key making has been an occupation that he inherited from his father. His family has been into key making for three generations now. Singh has three children, two boys and one girl who are 12, 7 and 2 years old respectively. He doesn't want his children to grow up to be key makers. His children are studying in a government school in Haryana. He hopes they complete their education till 12th at least. He says he would be willing and supportive of their decision and the kind of work that they eventually decide to do.

Expense/Income	Item	Amount per month
Income	Key Maker	13,500
Expense	Transportation	4500
Expense	Materials	1500

One of the major challenges faced by Singh is primarily due to the fast-paced world of automation and computerisation. He partially blames digital locks for the decrease in business over the last 6 years. Secondly, now-a-days, cars with a sensor key (button) have replaced the traditional manual key. This has also reduced his work. The difficulty in his work in terms of technology has gradually increased over the years. It takes him 35 minutes to break a lock whereas a machine takes not more than five minutes for the same. He says the demand for key makers hasn't completely declined, nor will it in the near future, but it will reduce substantially over the next 10 years.

Apart from this, Sucha Singh is sometimes intimidated by the police who often nag and blame small key makers like him for making duplicate keys for the cars which are stolen by local thieves. 'Chori

woh log karte hain, shak hum par aata hai.' He has to show his ID and call for help from local residents as a witness that he has been working in this locality since the past ten years.

Sucha Singh wants the government to recognise and acknowledge the work that he and many people like him in the informal sector do, be it key makers, clay pot sellers, juice stall owners, or cycle repairers. He says his business is as important as others' and should be reformed into a 'formal and solid business'. He plans on buying machines to reduce the time and efforts required.

19. Vijay Verma - Cobbler

Name: Vijay Verma,

Age: 30 years old

Education: 5th standard from a local school in Bihar

Occupation: Cobbler

Vijay Verma operates a tiny stall on the footpath near a T-junction in sector 1, Dwarka alongside a similar tea stall. 3 years ago, he migrated to Delhi from a small district in Samastipur, Bihar. He lives in a rented house along with his wife and three children, which is at walking distance from his stall. He rarely takes a day off as he starts his work at 9am and works for 10 hours at a stretch till 7 pm. Vijay engages in all kinds of repair work from stitching the sole of a slipper to fixing the chain of a school bag. Vijay purchases brushes, shoe polish, chains, laces, hammers and needles as raw materials to run his stall from a wholesale market in Dabri at a fixed price. He is unable to haggle with the dealer even though he buys the materials in bulk. In his hometown, he would assemble and stitch shoes in a local shoe company. Nobody in his family has ever held this sort of a job and he has no plans to teach his children the art of shoe repairing as he believes his children 'should do a job that provides with it a certain amount of dignity.' He says he's blessed with a daughter, aged six and two boys of ages ten and twelve years respectively. He says he doesn't have any business tactic or loyal customers, and he has managed to attract customers by word-of-mouth.

Vijay's earnings increase during the winter season as he is able to polish boots and leather sandals. He comfortably earns about 400-500 rupees a day in winters when the demand for shoe polishing is high. However, his sales are at the lowest during summer months when he able to bag only 200-300 rupees a day. It has only been 3 years into this business and Vijay has already sensed a decrease in his earnings. He blames the 'use-and-throw'' readymade footwear for this, as it is inexpensive and readily available. As a result, people have stopped getting their footwear repaired, and prefer to buy a new one instead. He also explains that the younger generation is unwilling to work as cobblers, it being a job which has no dignity. Because of the lack of an alternative, he and many such cobblers around Dwarka have taken up this profession.

Expense/Income	Item	Amount per month
Income	Shoe Repair stall	9000
Expense	Household rent	3000
Expense	Materials	1500
Expense	Children and household expenses	3000

Total		1000

Coming from a faraway state, Vijay is burdened with responsibilities and debt. He is bound to repay the loans taken by his father for his ailing mother. His father also took a loan for his sister's marriage. Vijay is debt-ridden as he depends on loans to finance immediate medical need and wedding expenses in his household. He is hopeful that he will eventually clear all the debt, but a paradigm shift from a 'one-time purchased sandal' to 'use and throw'. footwear has left him worried as it paints a grim picture of the future. His eyes gleam with joy when he thinks of going back home to his extended family. He doesn't have any future plans to expand his business, nor does he wish to continue as a cobbler. He may even shift to another profession which provides a better income, if given the opportunity.

20. Wajid Khan – Metal gate, grills and fencing repairer

Name: Wajid Khan

Age: 65 years old

Education: 6th standard in New Delhi

Occupation: Metal gate, grills and fencing repairer

Wajid works as a metal grill, fence and gate repairer in New Friends Colony. His family is from New Delhi, and he has been here his whole life. He lives with his wife 5 minutes away from his store. He rents a shopfront on a road adjacent to a main pedestrian road, across a *nala*. He pays 4000 rupees a month for rent, and about 1000 rupees per month for other costs such as electricity to run his machines and fan. He remains in his store from 9am to 7pm awaiting customers. He takes Sundays and festival days off.

Wajid initially learned this skill from his elder brother, who previously owned a store in Delhi. He has been doing this work since he was 20 years old. When he first started, he had a store on the main road nearby, and work was a lot better as the location attracted more customers.At that time, he was earning 1000 rupees a day on average. There was also a lot of construction happening in the area that helped him to get work from builders. Now, the construction in the area is over and there is less work. After 20 years, he was evicted from his first store after the property owner reported him for not paying electricity bills, although he maintained that he was. His store was raided and some machines were broken. He moved to the current cheaper store, as he did not have the finances to set up a larger store.

Overall, Wajid is dissatisfied with his work and ability to progress in life. He said, 'At 65, I am still lying here next to a *nala*.' The work that comes in is very variable. Sometime he has a week where he has work every day, but the following 15 days he may earn nothing. The biggest impediment to consistent work is the location of his shop. Because it is across a *nala*, he believes that people do not see his store, or if they do, they are unwilling to go there with their repair work. He would like to rent a store in a better location, but is unable to afford it. The stores he would prefer to rent out would charge around 6000-7000 rupees per month, and they usually ask for 1-2 months' rent in advance to secure. He is also unable to afford advertising to reach a wider range of customers.

Wajid uses machines that he has had for the last 10 years. The machines were bought second-hand from another repairer. He prefers to get them repaired when they break, as it is cheaper than buying new ones.

Wajid finds it difficult to estimate an average income for the month. 'I can't say how much I earn each month. Like I said, on some days I get work, but on many days I do not. Who would visit me

here?' At the time of the interview, he had not had any work in the past week, but on the day of the interview, he was repairing one metal door for 500 rupees. Every few weeks he gets a big job, such as repairing a large fence, and he earns 2000-3000 rupees over a couple of days. He is also willing to go to people's homes to complete more complex and large repair work, but he thinks that customers prefer hiring repairers from large stores as they appear to be more professional.

Wajid has been at this particular location for the last 15 years. One consequence of the unhygienic nature of his surroundings is that he found he was getting sick more often. Another issue is that sometimes the electricity gets cut off. Earlier in the year, the electricity stopped as the electricity company had lodged a case on the property owners. This took several weeks to resolve where he was not able to work on any jobs that required his sawing or cutting machines.

There are also fewer customers during monsoon as there are less people around. He also has to close the store for 2-3 weeks every monsoon as the nearby *nala* floods, and the store becomes difficult to access.

Expense/Income	Item	Average amount (rupees)
Expense	House rent	3000
	Shop rent	4000
	Electricity	1000
	Household expenses	2000
Income	Repair work	10,000
Total		***0***

Wajid has two sons, aged 18 and 20 years. They are both working in Delhi in different stores as assistants. Neither of them is interested in taking over this shop as it is not very lucrative.

Wajid feels that he is now getting old and his health is failing, but has no choice but to continue the work. The work can be physically demanding, as it uses some heavy cutting and welding machines. It is particularly difficult working outside in front of his shop in the sun during summer. He has pain in his knees, and often has back pain as well. He manage the pain with painkillers, as he cannot afford to go to a hospital or doctor. He has not tried to go to the hospital at all in the past few years, as he knows they will charge him something he cannot afford.

He does not feel he has the ability now to learn a new skill due to his age. He has also never taken a loan in his life. He has always been afraid of the risk of taking a loan as he does not have any

assets, and he is unsure if he would be able to make repayments. If he were to expand, it would require at least 4-5 lakh investment to purchase new machines and set up a larger store in a better area.

The main think Wajid believes the government needs to do is provide job opportunities for people to switch to if their business is not working. He believes he has no other options but to continue with this work, but he would be willing to work on projects for the government. There are fewer and fewer jobs these days in Delhi.

He would also greatly benefit from support that would help him either pay his rent, or rent a better-located shop. His biggest stress over the past 40 years has been paying rent to property owners and the fear of unfair treatment at their hands.

Annexure 3: Note on Production of Natural Fibres

Cotton, fibres are white, fluffy fibres generated from the cotton plant that is cultivated in warm climates. Most of the world's cotton is grown in the United States, Uzbekistan, China, and India. Other leading cotton-growing countries are Brazil, Pakistan, and Turkey. Successful cultivation of cotton requires a long frost-free period, abundant sunshine, and moderate rainfall. It requires fairly heavy soil, although the level of nutrients in it does not need to be exceptional. In general, these

conditions are met within the seasonally dry tropics and subtropics in the Northern and Southern Hemispheres; however, a large proportion of the cotton grown today is cultivated in areas with less rainfall that obtain the water from irrigation.

Cotton takes approximately six months to mature into capsules (bolls) which are left to dry and after that the cotton is ready to be harvested. The cotton bolls are either hand-picked or picked by machines. Once picked, some of the bolls may be wet, and therefore, need to be dried and undergo a dehydration process. After this, the seeds are separated from the fibres. This process is known as ginning. For this, there exist special ginning machines. After ginning, the fibres are compressed into rectangular bales, which are then sent to the yarn manufacturing mills where they can be spun into yarn. Then, they are sent to weaving mills where the cotton yarn can be woven into fabrics that can be sold commercially.

While cotton is a natural fibre, and is therefore more sustainable than synthetic fibres, it too has a very large ecological footprint due to the way it is produced. It is extremely water intensive. It can take up to 10,000 litres of water to produce 1 kilogram of cotton, which means that it takes about 2,700 litres to make 1 cotton t-shirt. The heavy dependence on water has had adverse effects on the areas where cotton is produced. Perhaps the most dramatic overuse of irrigation water is visible in Uzbekistan and Turkmenistan, where the Aral Sea has declined in surface area by 85%. Livelihoods, wildlife habitats and fish populations have been decimated.

Cotton is also susceptible to pests. To control the numerous pests feeding on the cotton plant, farmers have to rely on the heavy application of insecticides, which in turn leads to the pollution of surface and groundwater. Conventionally grown cotton requires the heavy use of synthetic fertilisers. Such concentrated application means much of it ends up in waterways, creating one of the worst nutrient pollution problems globally that affects aquatic communities and leads to dead zones starved of oxygen and devoid of aquatic life. In addition, synthetic fertilisers contribute an important quantity of greenhouse gases during their production and use. Since many of the dyes used conventionally are toxic synthetic chemicals that do not biodegrade, they end up in rivers, polluting them and creating toxic habitats for aquatic creatures.

To draw a comparison, the Textile Exchange used a life cycle assessment (LCA) for conventional cotton that was produced by Cotton Inc. in 2014, and then set out to create a similar LCA for **organic cotton**. Using this as a common metric, their aim has been to map out the differences between the two textiles in terms of their environmental impact. The findings revealed that organic cotton has the potential for environmental savings in several areas– there is 70% less acidification of land and water, the potential for soil erosion drops by 26%, surface and groundwater use falls to 91% and demand for energy could go down by as much as 62%.

In terms of water usage, organic cotton uses significantly lower quantities of water. Take a t-shirt, for example. According to the TextileExchange, a t-shirtmade out of conventional cotton would require approximately 8,206 litres of water as compared to one made out of organic cotton that would require about 704 litres (a difference of 7,502 litres). For a pair of jeans, conventional cotton would require approximately 37,513 litres of water as compared to about 3,528 litres required to make one with organic cotton (a saving of 33,985 litres).

Overall, organic cotton is considered to be a more sustainable alternative to conventional cotton; however, the most striking criticism of organic cotton is that it yields less cotton than its conventional counterpart. This makes it dependent on the area of the land it is cultivated on, and many say that it would require taking more land under cotton cultivation. This may not necessarily be the case, as some studies show that due to the absence of chemicals in the soil and the replenishment of groundwater, the conditions for organic cotton have become such that it is beginning to yield quantities of cotton that match the yield from conventional cotton fields.

Wool is a yarn obtained from the fleece of sheep, and thus, it is an animal-based fibre. It is a protein-based fibre, similar to human hair, called keratin. Sheep produce a new fleece every year, making it a replenishable source of fibres. The process of producing wool is roughly a five step process that includes shearing the fleece from sheep, scouring it, carding it, combing it and spinning it into yarn so that it can be used to create fabric.

Wool can be processed to create one of two distinct wool fabrics. These are woolens and worsteds. The fundamental difference lies in the type of fibres used to prepare the fabric. Woolens are made

with short, curly fibres that tend to uneven and weak. They usually have a lower thread count as compared to worsteds, and this makes them less durable. However, due to their loose weave, they are soft, fuzzy fabrics that tend to provide more warmth than worsteds. Worsteds, on the other hand, are made out of long, straight fibres and have a high thread count. The finish tends to be flat but smooth, and with less insulation capacity than woolens. Worsteds are also more expensive that woolens.

Wool, despite being a natural and biodegradable fibre, poses a few challenges to the environment. In addition to this, it is also considered unethical under specific circumstances. Like most other ruminants, sheep produce large quantities of methane every day. This is mainly due to their diet and eating habits. Methane is a major greenhouse gas. It contributes to the process of global warming, and is considered only second to carbon dioxide in this regard. A sheep can produce up to 30 litres of methane a day, and with an increase in the demand for wool, methane emissions increase as well.

Apart from this, the effects of animal grazing, whether beneficial or detrimental, are determined by how and where the grazing is taking place. The existing ecosystem, local conditions and policies of the area are significant contributors to grazing outcomes. In some cases, land can be overgrazed and become obsolete, but due to periodic pastoral patterns, land can be allowed to regenerate its nutrients. Policies that restrict or allow movement of livestock are significant in enabling either outcome, as is the expansion of agriculture since it reduces the available pasture land, forcing grazing of livestock to be concentrated in fewer areas and depleting the nutrients and arability of that land.

Questions of ethicality come into the picture due to the practice of mulesing and otherwise treating sheep harshly and violently. Flystrike is a problem faced by sheep, in which the area near their tails, due to its dampness and folds in the skin, attracts flies that lay eggs on the skin of the sheep. The larvae, after hatching, feed on the skin of sheep and can inflame the area, inviting infections that can lead to death. To prevent this, sheep undergo a procedure called mulesing. Mulesing involves slicing the skin around the sheep's tail to produce a scar free of wool, urine, feces, and wrinkles that could possibly attract flies. This procedure is usually done without anesthesia and causes the sheep

a lot of pain. The inhuman treatment of the sheep has generated outrage, and animal activists have advocated for better practices of animal healthcare.

Silk is a natural fibre derived from the protein filament secreted by certain larvae to make cocoons while they metamorphose. Silk is considered a luxurious fabric since it is expensive and laborious to produce. The practice of creating silk textiles out of silk is known as sericulture. Silk is conventionally obtained from the silkworm, also known as Bombyx mori. This is a moth that feeds only on the leaves of the mulberry tree, but due to its ability to produce silk, it has been entirely domesticated and cannot exist in the wild without human assistance.

Six weeks after hatching, the silkworm stops eating and is ready to spin its cocoon and transform into a chrysalis. It is at this stage that the silkworm produces the silk that is harvested. It takes the silkworm approximately 3 days to spin its cocoon, which can give almost a kilometre long silk fibre. At this point, the cocoons are sorted according to size and colour to maintain uniformity. To get a continuous unbroken fibre of silk from the cocoon, it is put into hot water to loosen the fibre from its shape and to simultaneously kill the pupa inside. After this, the fibre is reeled onto a wheel and inspected. When the fibre is nearly reeled, another fibre is stuck to its end to create a long continuous silk thread. After the washing and cleaning process, the silk is ready to be formed into yarn. The type of yarn produced depends on the way the strands of silk are twisted together; sheer fabrics are twisted tighter while thicker ones are more loosely twisted. This is followed by passing the silk yarn through rollers to ensure uniformity in its width, and after this, it is sent to fabric manufacturers.

In terms of its environmental impact, silk is a natural fibre that is biodegradeable, and the mulberry trees that silkworms feed on are resistant to pests and need less water than cotton plants. Thus, in many regards it poses less of a burden on natural resources. However, silk has come under scrutiny because of the treatment of silkworms. The process of procuring unbroken silk from cocoons requires harvesters to boil the cocoons, which kills the worms inside. This practice has been criticised and deemed unethical by many animal activists as well as leading fashion retailers. There is even a conversation regarding the sentience of the silkworm and its ability to experience pain in the silk harvesting process.

Linen is a textile made from the fibres of the flax plant, which grows well in colder climatic conditions. The flax plant is also a source of flax seeds and linseed oil. The flax fibres are obtained from the bast under the stem of the plant. These fibres are soft, flexible and look almost like blonde hair. The linen produced from these fibres is lightweight with acclimatising properties since it acts as an absorbent fabric during the summer and provides warmth in cooler temperatures. Producing flax is a slightly complicated process that is labour- intensive, making linen an expensive and luxurious textile.

The flax plant can be harvested approximately 100 days after planting. This is the point when the fibres of the plant are at their most desired quality. At this point, on the outside, the flax plant has withered leaves, a yellow stem, and brown seeds. The plant is ideally pulled straight out of the soil with the root intact rather than cut at the base; this ensures that none of the natural sap is lost which affects the quality of the linen. After the plant has been harvested, it undergoes retting; during this, the bark surrounding the fibres is allowed to decompose so that the fibres can be easily separated from it. There are multiple ways by which flax can be retted, such as by allowing dew to degrade the bark, submerging the flax in stagnant pools or running streams, or by treating it with chemicals. These different approaches can produce varying degrees of byproducts that affect the environment.

After retting, the fibres are passed through rollers that crush and separate the stalks from the fibres. The fibres are then combed and straightened in order to prepare them for spinning. This removes the shorter, coarser fibres and creates a suppler and uniform bundle of fibres. Theirs are sorted according to length and quality and spun into continuous long linen threads. The reels of linen thread are then sent to manufacturing mills where the yarn can be woven into linen fabric which is then ultimately made into consumable products.

When it comes to the environmental impact of linen, the main concern comes during the retting and the cultivation process. Retting by using chemicals results in the chemicals being released into water bodies. The remnant substances from retting should be treated before being released. When it comes to cultivating flax, very often, farmers treat the plants with chemical herbicides, pesticides,

and fertilisers, which then affect the soil and water quality. Therefore, an organic variant of linen exists as well. Apart from these factors, linen is considered to be a very sustainable fibre since it consumes substantially less water than cotton, doesn't require much use of chemical inputs during its cultivation, and at the end of its life cycle, it decomposes without adverse consequences.