



CAG

Citizen consumer and civic Action Group

Informal Waste Dynamics: Mapping Waste Trails

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Introduction: The waste crisis

The world is in dire need of managing its waste better. Rapid industrialization and rising consumption around the world are fast complicating what used to be an issue of collection and disposal into a much more complex issue. The nature and quantity of waste is changing rapidly such that there is a significant increase in toxic and/or nonbiodegradable materials that have far reaching and devastating effects on the environment and human and veterinary health. Developed countries have responded to this emergency by switching from reliance on landfills to incineration and recycling. Incineration is a costly and environmentally unfriendly solution while their recycling process is heavily reliant upon shipping off more complex materials to be dealt with by developing countries with laxer regulation standards than their own. The United States is the largest national plastic waste exporter while the European Union is the largest regional exporter (GAIA report). Whether government or privately run, there is a tendency to favour a centralised system which is always less sustainable than a decentralised system.

In contrast, the informal sector in developing countries has risen to fill the gaps unmet by the local governments and has adapted to the new business opportunities brought in by the changing nature of waste materials. Given the low-cost, low-carbon nature of this system, it is worth exploring and expanding further. However a major challenge in integrating and mainstreaming the informal economy with any government or business initiative is the lack of information regarding the informal waste economy, its scope and alternate processes. Furthermore the informal nature of this sector renders the socioeconomic status of these workers more vulnerable and susceptible to exploitation; it allows for players, whether belonging to the government or private businesses, to exploit and ignore their basic rights as citizens and workers. It is a societal and systemic failure that those who contribute towards the environmental health of the city are the ones to be exposed to unsafe, unhygienic pollutants and hazards in the process of cleaning it up.

The particular problem of plastic and relevance of the informal waste sector

Of all the materials that land up as waste, plastic pollution has gained a lot of traction worldwide. Plastic is a fairly new material given human history; its widespread use began only in the 1950s with a growth rate that is only beaten by cement and steel(). But factors such as convenience, durability and cost-effectiveness of this material which have made it ubiquitous are the same reasons why it is such a cause for concern today. Plastic tends to accumulate rather than decompose in landfills and is estimated to take between 100-1000 years to decompose. With the global recycling rate covering only 9% of plastic produced thus far, the need to improve upon current recycling practices and processes becomes all the more essential.

Thus considering that in developing countries the informal waste sector is currently the one primarily diverting plastic waste from landfills in order to give it a new lease of life through recycling, it would be beneficial for all concerned to explore this intersection

further. This could potentially lead to improvements in the efficacy and reach of the informal waste economy and thus reduce the quantity of plastic waste as well as improve the lives and livelihoods of these workers.

The need to acknowledge the role of the informal economy

In India, there is currently some legal recognition of the informal waste economy's contribution as evidenced by the Solid Waste Management Rules, 2016 issued by the Ministry of Forest, Environment and Climate Change as well as a growing recognition of the business scope possible in this field by entrepreneurial initiatives such as The Kabadiwalla or The Paperman. However, the lack of adequate information about the actors and processes of the informal waste economy serves as a major handicap towards such efforts. If there is more awareness about the contribution of the informal sector in terms of quality, quantity, price of materials picked, this would encourage the private sector to organise or set up a chain employing informal workers.

This report is motivated by the understanding that relevant information regarding the informal waste sector, its actors, its processes, its challenges and strengths will help bring in greater inclusivity for this sector and offer socioeconomic protection for these workers. Aside from exclusion, lack of information renders these people invisible and illegitimate in the eyes of the law where their rights as citizens and workers are exploited. This report wishes to contribute towards a change of attitude in government and society by providing a better understanding of the immense environmental, social and economic benefits these workers contribute in very trying and exploitative circumstances.

Scope of this study

The report focuses specifically on the city of Chennai, a mega city having one of the highest per capita garbage among the large metro cities of India. It is estimated that about 5000 tons of unsegregated waste find their way to two landfills every single day. Chennai has two major landfills, Perungudi in the south and Kodungaiyur in the north. As a result of waste being concentrated in these two dumpyards, informal waste economies have grown around these areas. Thus, in order to learn more about the processes and flows of the informal waste economy, we have focused on Kodungaiyur as the site of research. This is because we have already established relations with the communities living around this particular dumpsite as well as partner organisations with whom we have conducted health camps and commenced the initiation of procuring identity cards for waste pickers.

We begin at the bottom of the waste trail chain with waste pickers, moving next in line to scrap shop owners, followed by retailers, wholesalers, processors finally ending with manufacturers. This includes all the actors involved in all these steps such as the workers hired for the job of separating or processing plastic or anyone with links to trade unions. We stop at manufacturers since beyond this stage, we enter into sales and thus step into a new domain. In this trail, we have chosen to focus on Polyethylene Terephthalate (PET) and High-Density Polyethylene (HDPE) as these two types of

plastics are most abundantly found and commonly recycled. The waste pickers tend to ignore the other kinds of plastics because the monetary benefit acquired through them is less considering the effort required to pick them. Commonly sold and used plastics such as plastic carry bags and low quality plastic under 20 microns figure in this category, rendering them a low priority for waste pickers. Others like multi layered or shiny plastics (a preferred option for quick perishable goods such as biscuits and chips) or Tetrapaks (commonly used for juices and milk products) are ignored: it is simply too complex, time-consuming or expensive to separate the different components in order to recycle them separately by kabadiwallas. Keeping these factors in mind, we have decided to focus on these two types of plastic.

The informal waste economy in India

Given that lack of information is a major issue regarding the informal waste economy, the meagre existing body of literature that does shed light on this topic plays a critical role in building a baseline for us to conduct our research. Much of the research done on this subject in India is focused on cases in Delhi and Pune, owing to a combination of waste workers that are more organised, municipalities that are more receptive and NGOs that are capable of working with the particular temperament and lifestyle of informal workers. The following is a distillation of the literature review done on the informal waste economy. In a report called “Rising from the Waste” synthesising the existing body of work on the informal waste pickers in India, Thailand and the Philippines, researchers broadly categorise the kind of initiatives that are being taken in India around this subject in the following list:

- Organisation of waste pickers into trade union/cooperative/Self Help Groups/Associations
- Issue of photo-identity cards to waste pickers – in a few cities these have been endorsed by the municipalities
- Elimination of child labour in the sector and promotion of education among children of waste pickers and child waste pickers
- Increasing access to credit through self help groups and credit cooperatives
- Market based interventions such as cooperative scrap stores
- Interventions to integrate waste pickers into solid waste management in order to improve their conditions of work as waste pickers
- Increasing access to social protection such as life insurance and medical insurance
- Research to establish and quantify the contribution of waste pickers to solid waste management
- Advocacy for all of the above.

This serves as a good summary of all the efforts and actions being made across India regarding the informal waste pickers condition. This also helps to situate our aims, enabled by this report, for the larger nationwide endeavours. As a research and policy organisation, despite having been involved in advocating for the issuance of photo-identity cards for the local waste pickers in Chennai and in supporting partner

organisations with health camps, our primary aim, through this report, is to research in order to quantify and disseminate the contribution of waste pickers to solid waste management in Chennai.

Comparison between Global North and South response to the waste crisis

Waste management is in crisis worldwide. The issue is more visible in developing countries with unscientific landfills capsizing with mixed waste and littering a common practice among citizens. However, the problems of waste only appear to be addressed in developed countries owing to their excellent collection system. Regardless of a proper collection system in place, the ubiquitous trend of urbanisation and industrialisation means there is a rapidly increasing quantity of commodities circulated; the amount of waste is growing exponentially but worse, the nature of waste is shifting to more toxic and non-biodegradable materials. Where once waste consisted mainly of biodegradable matter which could easily disintegrate and be reabsorbed by nature, now we have to mitigate the adverse consequences of medical waste, electronic waste, chemical waste, non-biodegradable waste and the effect of all of these mixed together. There are enough scientific studies that have slowly begun to seep into public awareness about the ramifications of these to public health and the environment and yet, other than isolated and small-scale initiatives on community- or city-level, no country has succeeded in effectively addressing the issue of managing waste.

Developing countries have responded to this crisis by moving towards privatisation, mechanisation and a reliance on technologies such as incineration, minimising their dependency on landfills as a result. They have been developing more and more sophisticated and detailed segregation system for waste but while the collection system might be excellent, the responsibility for the actual recycling process for collected materials are literally shipped off to developing countries where it is a known fact that the laws and regulations are much more lax than those followed in developed countries. Whether government run or privately, developed countries favour a centralised, mechanised approach which along with privatisation run counter to social goals of sustainability and justice.

For reasons that can be attributed to the largely informal nature of the workforce in developing countries, absence of regulations and the inadequacies of governments, an informal sector, ranging from waste pickers to processors, has stepped up to play a critical role in the waste management of these countries. However there is little recognition of the contribution of this informal sector by the governments or societies of these countries.

Government's relation with the informal waste sector

In fact, discrimination and persecution are intrinsic to this sector. It was only from the 2000s that the management of waste was addressed directly as a separate issue when the first Municipal Solid Waste (Management & Handling), 2000 was issued by the Ministry of Environment, Forest and Climate Change. Most of the rules were influenced

by the findings of a committee set up by the Supreme Court of India following a Public Interest Litigation by Almira Patel and others against the failures in the management of waste. The government has moved towards relying on privatisation and incineration technologies, Delhi being a forerunner in both. Despite setting aside the fact that chemical toxins released in the high temperatures necessary to break down waste and tricky question of whether we can trust our systems to maintain and monitor these complex and expensive equipments and technologies involved, incineration of waste-to-energy technologies simply run counter to the waste hierarchy principles: they compete with the same material as recycling programs and create a demand for a steady supply of waste for the price of a poor quantity of energy generated. There exists enough body of reporting to prove that privatisation is not the right solution either. The current privatisation model has the cost factor linked to the weight of garbage, incentivising malpractices such as mixing sand and other deposits to increase the weight of garbage collected while discouraging attempts to divert waste.

This trend of privatisation and mechanisation is a threat to the informal waste economy. This impacts a significant number of people considering the World Bank estimates that about 1% of India's working population is engaged in this sector. This trend is due to a strong lobby that bases itself on the belief that privatisation of garbage will lead to cheaper, more efficient results. While this is yet to be proven, there have been studies that counter this view by capturing the economic benefits of the informal waste economy, pinning the net benefit of the informal system at € 9.300.082 every year.

The economic and social impact of the informal waste economy

It is not simply that the informal system has tangible economic benefits as opposed to the loss-making model generated by the formal system. The informal waste economy, being a labour-intensive field, depends on non-renewable energy resources significantly less than the formal system.. This includes the reprocessing level as well, where especially for plastic processing, manual processes are relatively higher compared to the higher level of automation used to process other materials. It runs at lower costs than the formal system while employing twice as many people, 63% for whom this is the only source of livelihood. This source of livelihood is significant as it exceeds the statutory minimum wage. The figures clearly indicate that the informal waste economy plays an important role in providing employment for the poor and alleviating their state of destitution. Given the informal nature of these livelihoods it is inevitable that there is an underrepresentation of the actual workforce, despite the available numbers covering a considerable pool of people. A conservative estimate of the number of informal waste pickers alone would pin them to 1.5 million workers while 1% of the urban population is estimated to be engaged in the informal recycling economy. Efforts towards privatisation and mechanisation which adversely impact the informal waste economy are therefore jeopardising the lives and livelihood of a significant portion of the poor population. Where once waste pickers had free access to waste bins, now they must pay or be relegated solely to dumpyards.

The World Class City aspiration

This non-inclusive privatisation of waste fits into a larger narrative of India's aspirations towards living up to the standards of a developed country. The 90s already saw a host of policies and executive moves that were already aligned towards an aesthetic, urban India that prioritised the resettlement of slum-dwellers to open up space for private enterprises, aesthetic growth and so-called 'development'. However it was only in the 2000s that courts also began to harden their stand against slums following an increase in Public Interest Litigations (PIL) filed against slums by Resident Welfare Associations mobilised on terms of quality of life and security issues. This combined with the 2003 announcement of the successful bid for hosting the Commonwealth Games in Delhi, caused state and municipal governments to face a combination of top and bottom level pressure to conform towards what was essentially a beautification process where, that which did not fit the image of a world class city, namely the poor and by extension their slums, was considered illegal, or a "nuisance" and systematically displaced or removed (Ghertner, Ruled by aesthetics 2011).

This aspiration towards a developed country and this outlook of equating legality largely with a certain appearance/aesthetics has adversely impacted the informal waste economy in many ways. Aside from the many slum demolitions, courtesy of the PILs requests from RWAs, many scrap and junk shops have been shut down on the basis of appearing "dirty" and "polluting". Most famously, Sunday Bazaar, a second hand goods market where an estimated 1100 registered and 2000 unregistered persons sold repaired or recycled items salvaged from dumps and bins, was relocated to make space for a cabinet minister to establish a green zone. The social and visual influences to the condition of the informal waste sector cannot be ignored, especially considering how many of the evictions and demolitions were motivated by resident-led PILs. The attitude of the relative upper class towards the informal waste sector plays a considerable role in its fate.

Informal Waste Economy: breaking down its structure

It is time to unpack the term informal waste sector to uncover what it consists of. While there can be particularities that differ, in general the informal waste economy has a pyramidal structure, starting from waste pickers at the base and reaching, through progressive consolidation, to reprocessors at the apex. Within this pyramid there exists a number of formal and informal players. The first stage which consists of scrap collection is done by waste pickers and itinerant buyers in Asia. **Waste pickers** working outside the jurisdiction of any formal engagement, whether private or public, form the lowest rung of this structure. Owing to the pyramidal structure of the informal economy, this means that waste pickers are the most important section of the informal waste economy, numerically speaking.

They usually rummage through garbage bins or pick through landfills in search of plastic, metal or glass scrapes. There is usually a gendered dimension to this profession in Asia, where waste pickers are most often women. However there are exceptions to

this rule, like in the case of Delhi where the ratio of men is significantly higher (rights for wp). Marginally above them, and often interchangeably, are **itinerant buyers** that purchase biodegradable waste such as newspaper stacks from households. The waste these buyers engage with is significantly cleaner and uncontaminated since householders stock them separately for the purpose of resale, unlike the waste which waste pickers deal with which is mixed with organic waste. There is a third category of **informal refuse collectors** that straddles between the informal and formal binary. These are waste pickers or itinerant buyers that have been incorporated by the municipalities in the door-to-door collection process. The income from the sale of the recyclables collected as well as a collection fee is part of this understanding. It is important to note that there exists an element of competition between wage employers, municipal or contracted workers of the municipalities and waste pickers, as the former often do their own triage to privately make money off the recyclables sold, an additional effort which is separate from the official requirements of their profession. This must be taken into account when there are attempts to integrate the informal waste economy into the formal waste management system. In 2005, before the Solid Waste Management Rules, 2016 made door to door collection a mandatory responsibility of municipalities, the costs of hiring regular labour to fulfil this purpose did not feature in the municipal budgets. This opened up a space for waste pickers in Pune to negotiate, with the help of the organisation KKP KP, a public private partnership to fill that requirement without encroaching upon the municipal workers' jurisdiction (rising from waste). While collection is not limited to plastic, a study in Delhi indicates that plastic earns waste pickers the maximum percentage of revenue by a significant measure (rising from waste).

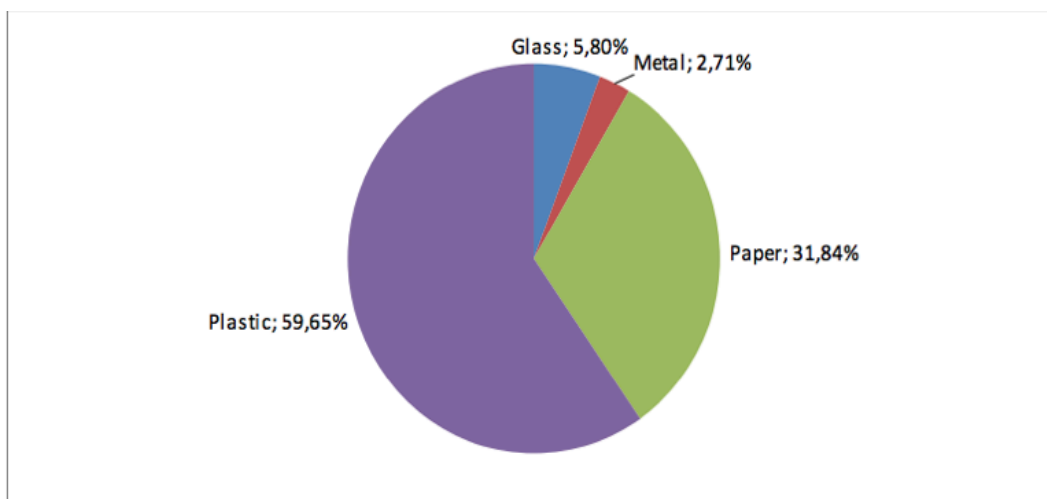


Fig 5. Percentages of revenue earned from various types of materials by wastepickers, on average

Given that plastic generates more revenue than any of the other materials, it seems logical to surmise then that the main focus for the majority of waste pickers would strategically fall upon collecting plastic scraps. Waste pickers further prioritise certain kinds of plastic over others. PET and HDPE are the most commonly recycled types of

plastic. The type of plastics can be identified by both consumers and recyclers thanks to the stamp now universally placed on the products by manufacturers. These markings are based on a classification set up by the Society of Plastic Industry (SPI) in 1988, a classification of seven categories ranked following the logic of most to least commonly recycled. Consequently waste pickers are always on the lookout for PET and HDPE, identified by their respective SPI classification numbers 1 and 2 (different polymer types).



Polyethylene Terephthalate sometimes absorbs odours and flavours from foods and drinks that are stored in them. Items made from this plastic are **commonly recycled**. PET(E) plastic is used to make many common household items like beverage bottles, medicine jars, rope, clothing and carpet fibre.



High-Density Polyethylene products are very safe and are not known to transmit any chemicals into foods or drinks. HDPE products are **commonly recycled**. Items made from this plastic include containers for milk, motor oil, shampoos and conditioners, soap bottles, detergents, and bleaches. It is **NEVER** safe to reuse an HDPE bottle as a food or drink container if it didn't originally contain food or drink.

Stocking, amassing and reprocessing of plastic

After the collection stage is the stocking and amassing stage. This consists of different categories of **scrap traders** such as **retailers, stockists and wholesalers** who are often registered under the Shops and Establishment Act, a state legislation that provides formal rights and obligations to employers and employees in the unauthorised sector of employment (rising from waste). Scrap trade generally holds a low status in the hierarchy of commodity trades. Despite the pro-environmental role it plays or the profit potential it holds, there is no respectability afforded to those in this profession, largely because scrap from the garbage is considered dirty. Furthermore this profession requires continued interaction with people from the 'lower' castes.

It is however primarily for this very reason that our research has a special focus on scrap trade: the particular relationship it holds with the informal waste pickers. Scrap traders tend to set shop near areas where waste pickers live and sort their waste and have long standing relationships with these waste pickers. They tend to have a daily interaction or transaction with waste pickers as the latter, due to lack of storage capacity, usually sell their day's worth of picking every day (rights for ww). In the absence of any formal employer-employee relationship, it is worth discovering what is the nature of the engagement between the two and how the rights of waste pickers are denied or asserted despite the absence of a legal framework to define its scope.

Besides the transactional exchange with waste pickers, scrap traders also require workers for sorting, cleaning, grading, baling as well as loading operations (rftw).

Next in line is the **reprocessing** stage. The processing of plastics is typically done by the informal sector as opposed to paper, cardboard, metals and glass. Concurrently there is a higher tendency of relying on manual processes in the case of plastics, unlike the other materials which have a higher degree of automation involved (rising from waste). Since this stage in itself may be formalised to a certain degree or will go on to engage with formal industries, it is worth exploring the dynamics in this liminal stage. Furthermore, there can be serious health impacts for the workers given the toxic components in plastic and the lack of regulation and safety measures in an informal work setting. Thus informed of the mounting problem of waste coupled with the complications that arise with the varying nature of waste shifting dramatically towards non biodegradable materials and with an understanding of how the informal waste economy fulfils a critical role--at great personal consequences-- in the mitigation of this problem, our research attempts to answer the following questions:

1. How is the informal waste network within specific contexts in Chennai laid out?
2. What are the actors, networks, processes and material flows that make up this section of the informal waste network?
3. What is the profile of waste-pickers working as part of these systems and what are the major challenges to their livelihood and well-being?

Methodology

Project research objectives

Problem Outcome: To create evidence of the contributions of the informal waste sector to municipal solid waste management, keeping in mind the human dimension (needs and capabilities of waste pickers)	
Project Objectives	Project Activities
1. To understand the informal waste economy, its scope, its constituents and value chains	<ul style="list-style-type: none"> ● Literature review ● Observation ● In-depth study ● Semi-structured interviews ● Surveys
2. Document and research networks, processes and actors within and linked to the informal waste network	<ul style="list-style-type: none"> ● In-depth study ● Spatial mapping ● Blogs ● Final report

Field sites and field communities - scope

For the purpose of this study, the areas in and around Kodungaiyur, were selected as the primary field site. Kodungaiyur, by virtue of being one of the two major dumpsites of Chennai, has an informal waste economy of waste pickers and scrap shop dealers that has organically grown around it. This concentration of waste and the chain of different actors informally working with it offers a microcosm of the general dynamics and practices of the informal waste economy we are seeking to understand.

The reason we chose Kodungaiyur as our prime site for an in-depth study rather than Perungudi, Chennai's other major dump yard, is due to our organisation's prior engagement and familiarity with this area. We have conducted a series of health camps and occupational identity card camps to facilitate their integration into municipal waste management. As a result, we already have partner organisations in place who can help us gain a much needed entry where the precarious nature of these informal workers' professions render them suspicious of any outsider's interest in them. The very unfavourable discourse that we are attempting to tackle with our study about these informal waste workers that sees them as an unwanted, illegal nuisance and does not acknowledge their tremendous contribution to the health and environment of the city could be interpreted as an attempt to gather information to further that cause and be used to displace them or endanger their livelihood.

Project phases and data collection methods

A combination of qualitative and quantitative approaches were used to obtain an in-depth understanding of the informal waste economy. The following are the primary tools and activities specifically chosen to do justice to both: (i) in-depth qualitative research, (ii) spatial and process mapping and finally (iii) quantitative surveys.

(i) **In-depth qualitative research** relied on ethnographic work which consisted of a combination of observation, recessed and semi-structured interviews: CAG researchers began by observing the chosen field site and trailing the waste chain. Three days of the week were dedicated to gather relevant information to understand the daily routines, work practices and the general environment within which the informal waste economy was situated. This period was also dedicated to identify the different geo locations and map the various stakeholders involved. We began with the bottom end of the chain—informal waste pickers—subsequently moving on to the next rungs based on the insights provided by subjects. Informal discussions and semi-structured interviews were conducted to build a rapport and win the trust of the communities, both residential and commercial, living in and around Kodungaiyur. As outsiders, this was a vital step to acquire any meaningful leads for our study. The first step therefore focused primarily on building relationships and getting a sense of the context within which we would be

conducting our study. These became fodder that guided our research questions and choice of respondents.

(ii) **Spatial mapping** was done in two parts. The first consisted of CAG researchers getting a sense of the physical layout and understanding how waste travelled through the chain as it underwent a series of sorting and refinement. The process mapping captured the different actors and activities of those engaged in the informal waste economy. The second was a more technical spatial mapping done during the quantitative surveys where, through the use of KoBo Tool box, the specific GPS locations were captured of the selected scrap shops whose owners and workers were interviewed. This app is designed to be able to capture location points offline, requiring an internet connection only at the moment of importing data. This could be done at a later point, as the app automatically imports all the information onto a google sheet, ready for data analysis. Maps were made using the Google Maps app. All choices for technology were made keeping the principles of open data in mind, therefore choosing easy to use and easily understandable free tools.

(iii) The final step was the creation of **quantitative surveys** which included a mix of open and close ended questions. Potential respondents were identified during the qualitative research stage. In addition to this, volunteers from our partner organisations were trained to conduct surveys using the Kobo Tool box as well as carefully explain the purpose behind these surveys. The questionnaire was prepared in English but volunteers were instructed to address the questions in Tamil since the respondents are more at ease with speaking in Tamil. There were two questionnaires, one was directed towards scrap shop owners with a specific focus on quantities and rates whereas the second one, aimed at the workers in these scrap shops, explored health aspects, work conditions and access to basic facilities. The tools were expressly selected to ensure ease of use and scaling of work.

At every step of the research methodology, tools and plan of action were refined based on findings and insights discovered during ethnographic engagement with different stakeholders of the waste economy.

Field Sites and Communities – exclusions and inclusions

Based on our prior engagements, partner organisations and time and personnel constraints, our research field site was limited to Kodungaiyur. As one of Chennai's two biggest dumpyards, it worked as a perfect microcosm to obtain a better understanding of the informal waste economy. Our criteria for field respondents was subsequently tied to this strategic delineation of spatial boundary and consisted of communities that existed in and around Kodungaiyur. This included both the residential and economic communities living or working in this area.

As the research progressed, it was fine tuned to focus specifically on scrap shop traders as we discovered that there were two streams through which waste travelled in the informal recycling sector, in one of which the informal waste pickers did not play any

role. Scrap traders however were the common base for both those streams. They were also the primary, if not the only point of contact for informal waste pickers, as they either bought waste pickers day's worth of collected plastics or employed them for the sorting, cleaning and process and other work necessary in their stage of stocking and reselling.

More specifically, our target subjects for this study were scrap shop dealers of plastic, as opposed to those of the more organised trades such as paper, glass or metal. And considering our special interest in PET and HDPE, we focused on scrap traders dealing principally with these two types of plastics.

Since this study was not motivated to understand the informal waste economy purely for its economic contribution but was also invested in improving the social aspects of those at the bottom of this informal waste chain, namely informal waste pickers, the workers of these scrap shops were also included in order to gain insights on their health conditions, access to basic rights and other economic and social aspects.

Child labourers were not included, nor was there a specific attempt to reach out to women or unionised workers as these would lead to other themes and angles beyond the scope of our study.

Research Techniques and Tools

Prior to project commencement, an **in-depth literature review** was conducted to immerse ourselves in the major discussions and debates surrounding informal waste pickers worldwide and in India. These, along with CAG's prior work with the informal waste economy, helped inform us of the major themes and issues regarding this field and built the critical baseline necessary to create our own objectives and direct the kind of insights we wished to gain.

This was followed by iterative and reiterative **ethnographic research**, as these insights helped fine-tune and improve our study's objectives and scope. During this qualitative research, **semi-structured interviews** were used to derive relevant information from pertinent stakeholders. These interviews and our choice of respondents were heavily shaped by the insights derived from our literature review and ethnographic observations but given the scanty nature of information existing about the informal waste economy in general and more specifically for Chennai, it was a strategic decision to keep these interviews relatively open-ended. This ensured that while we were armed with predetermined questions to tackle certain key themes, it allowed for informants to reveal new insights and leads.

To balance the qualitative side of this study, **quantitative surveys** were designed and used on 100 scrap shop traders and fifty-three of their scrap labourers. There were two **questionnaires** formulated, one addressed to scrap shop owners where we were more concerned with quantities and rates whereas the other one designed for scrap shop labourers we were more keen to understand the social and economic climate within which these workers worked. For the same motivations that led us to opt for

semi-structured interviews, we attempted to maintain a balance of open and close ended questions for these surveys as well.

Kobo Tool box was the choice of app to administer these surveys. It was picked due to the fact that it is simple to use, easy to scale and relies on accessible mobile phone technology without requiring an Internet connection during the phase of data collection. Testing of the app and questionnaire was first practised by the researcher designing it then with the volunteers of our partner organisation. Since they were new to Kobo Tool box, CAG researchers conducted a training workshop for them. The questionnaires were also piloted close to the CAG office in Teynampet and Alwarpet in order to receive feedback and adjust the questions before beginning the actual surveys.

Data collectors were mainly college students who were volunteering for one of our partner organisations-- Real Charitable Trust (RCT)-- while pursuing their undergraduate course. There were six of them in total assisting us, four male students and two female staff members of RCT. They were all Tamil speaking and had a prior engagement with communities around Kodungaiyur and therefore had what could be considered as an insider status among these communities. They were oriented about the research objectives, data collection tools, ethics of data collection, and trained on Kobo tool and the data collection process. Skill development training was also conducted in the field before gathering the data. As the data collectors gained confidence they were integrated into the field to interact with the scrap shop owners and labourers. All the data collection activities were directly monitored by the researcher. Monetary support was provided to the data collectors at the end of the data collection process, as per the terms of the contract.

Convenience sampling was used for the selection of field respondents. This was the preferred sampling method because scrap shops could be found everywhere and thus we were restricted to reaching out to areas where they were located. This is why probability based sampling methods that attempt to eliminate the possibility of bias could not be chosen. As the study focused on Kodungaiyur as primary field site, keeping it as the centre, six areas (Perambur, Kodungaiyur, Tondiarpet, Vyasarpadi, Otteri and Pulianthope) of North Chennai were picked.

Study Parts	Focus	Samples	Data Sources
In-depth qualitative study	Scrap shop	5	Observation In-depth study Semi structured interviews
	Processing unit	4	Observation Semi structured interviews
	Manufacturers	5	Observation Semi structured interviews
Mapping	Spatial & Process		Kobo
Quantitative data	Scrap shop owners	101	Survey
	Scrap shop labours	53	Survey

Key domains

After careful deliberation, based first from CAG's prior experiences working with the informal sector then recalibrated by insights from our literature review and findings from our fieldwork, these are the **key themes and domains** that were guiding our research. These ensured that we maintain clarity in the different phases of our research, especially allowing us to keep a sense of direction while allowing for open questions, a crucial element in keeping our predetermined ideas from overshadowing possible discoveries:

- Stakeholder mapping (interaction with waste pickers, scrap dealers/processors/manufacturers, communities, corporation officials, etc)
- Waste pickers socio-economic profile (this includes tangible aspects such as demographics or family background but also covered attitudes on waste picking, social and economic status, etc)
- Links between livelihood and wellbeing (sanitation, health, hygiene, access to medical care, etc)
- Work patterns (working hours, pay, conditions of work, safety equipment, relationship between owner and worker etc)
- Collection and type of waste (quantities and types of scrap collected, method of collection, equipment (or lack thereof) involved)
- Processing and selling of waste (storing, sorting and selling of waste, key players or workers involved)
- Risk patterns and coping mechanisms involved (occupational stigma, social/economic status, views on waste, financial troubles, security mechanisms, etc)
- Boundaries between formal and informal activities (which were considered informal, the blurred boundaries between the two activities, the relationship between key actors and the government or law, etc)

Challenges

As the **two lead researchers** assigned for this study were male and native speakers, entry into the communities in Kodungaiyur was relatively easy. However, there were two kinds of challenges they faced due to the blurred lines of formal and informal activities. Those in the lower end of the informal waste economy, namely waste pickers and scrap shop dealers, would be suspicious of the researchers since the informal nature of their work made them vulnerable and open to question and suspicion by legal and established authorities. They did not want attention drawn to their activities as they were uncertain what its repercussions would be. On the other hand, those in the higher end of the informal waste chain such as processors or manufacturers who had a certain level of formal or legal papers and licences were reluctant to share information for different reasons. Perhaps not wishing to draw attention to informal engagements and activities that were part and parcel of their formal enterprise, they would either ignore the researchers or fix appointments without showing up. The two researchers had to

navigate these obstacles in order to build meaningful relationships and draw relevant insights.

Quantitative data - statistical analysis

Survey data was collected from owners of scrap shops and their labourers in North Chennai, specifically from the following areas: Perambur, Vyasarpadi, Pulianthope, Otteri, Tondiarpet and Kodungaiyur. Out of the total 154 samples taken, 66% (n=101) of entries were collected from scrap shop owners and 34% (n=53) from scrap shop labourers. Among these 101 owners interviewed, 95% (n=95) were male owners whereas of the 53 labourers who participated in our surveys 70% (n=37) were men. Patterns in age groups have also been captured: the largest group among the 101 owners, at 39% (n=39), belonged to the age group of 41-50 years, closely followed, at 38% (n=38), with those belonging to the age group of 51-60 years. The larger pool of labourers tended to be younger, with 32% (n=17) of the respondents belonging to the age group falling between 21-30 years and 28% (n=15) are between 31-40 years old. The classification of demographic characteristics according to owners and labourers are provided below.

Demographic details

Table 1

Characteristics	Sub-features	Owners		Labours	
		(n=101)	Percentage	(n=53)	Percentage
Gender	Male	95	94%	37	70%
	Female	6	6%	16	30%
Age (years)	11-20	0	0%	5	9%
	21-30	0	0%	17	32%
	31-40	15	14%	15	28%
	41-50	39	39%	12	22%
	51-60	38	38%	3	6%
	61-70	9	9%	2	4%

Geographic details

Keeping Kodungaiyur as the centre and defined by the locations of available scrap shops, the surveys were conducted in selective zones and wards of North Chennai. The following are maps containing geolocation points of scrap shops of the owners and labourers who have been surveyed.

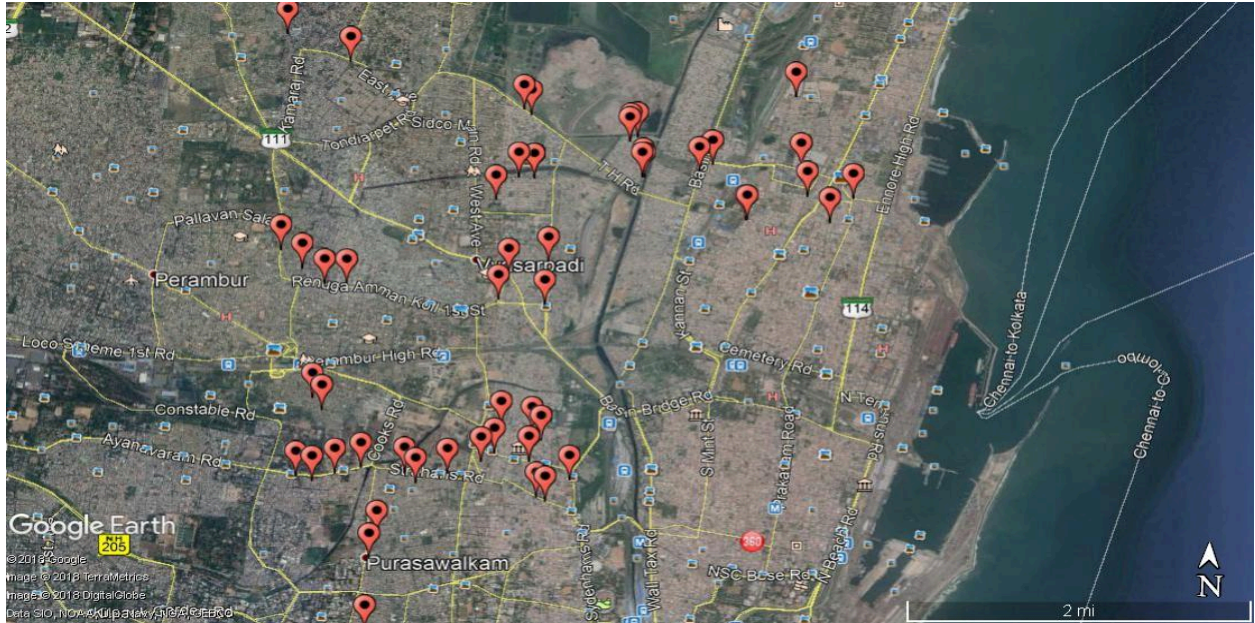


Image: Geolocation points of where survey of scrap shop labourers was conducted

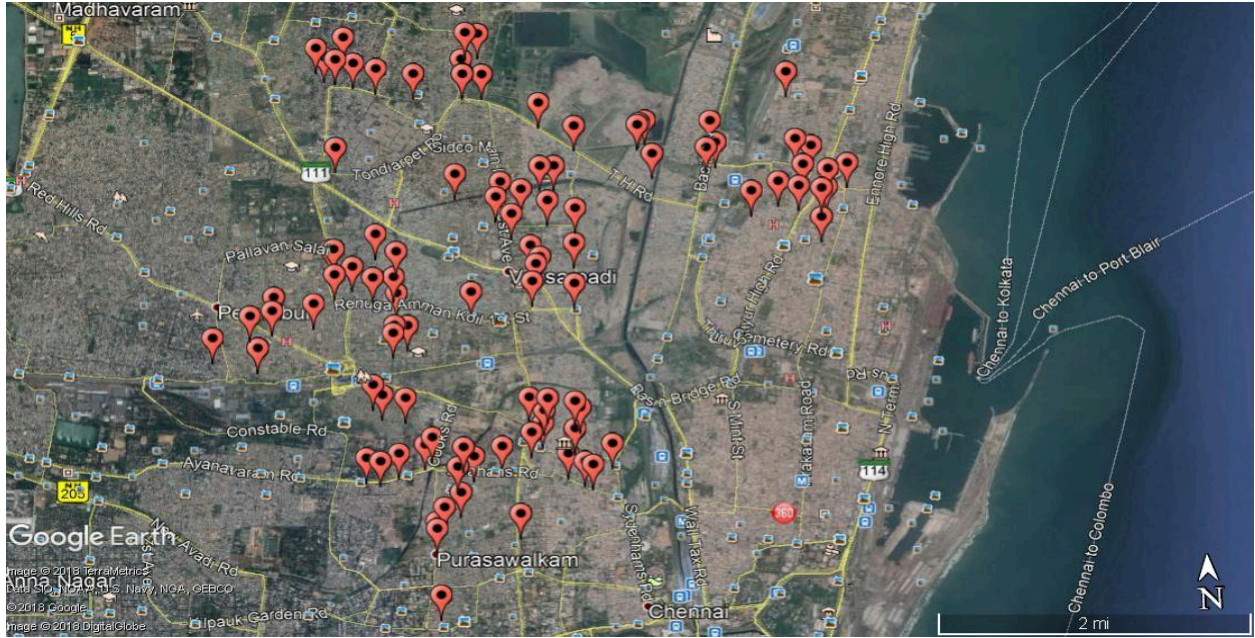


Image: Geolocation points of scrap shop owners surveyed

Moving on next to other major findings from questions which were addressed specifically to the owners and labourers. Key findings from the survey conducted by the 101 scrap shop owners will be analysed below using table and graphical representation on the factors and values followed by those from our survey with the 53 scrap shop labourers.

Figure 1

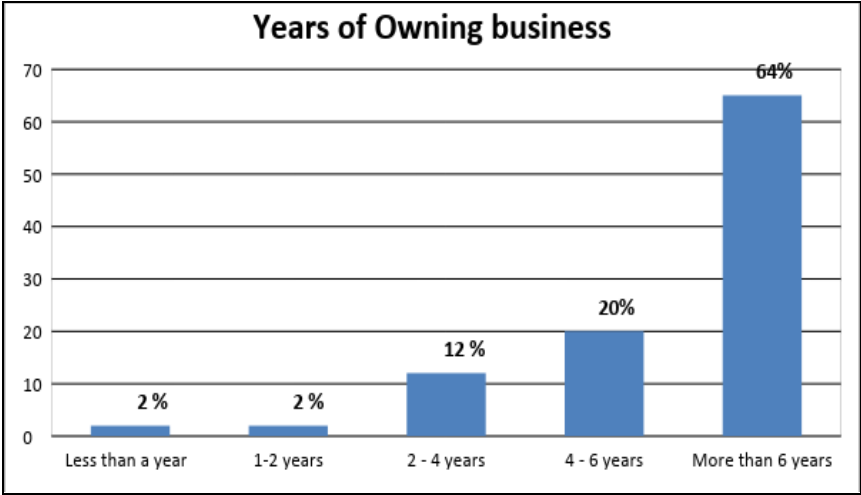


Figure 1 clearly demonstrates that among 101 respondents, that a significant majority (64%) own their business for over 6 years, followed by 20% who own their business for 4-6 years, while a nominal 2% have had theirs for 1-2 years matched by another 2% for less than a year. Majority of the owners are existing in the business which has a more informal setup.

Another factor which our research was particularly interested to uncover from scrap shop owners was the source of recyclable plastics they collect. The following table and diagram sheds light on this.

Figure 2

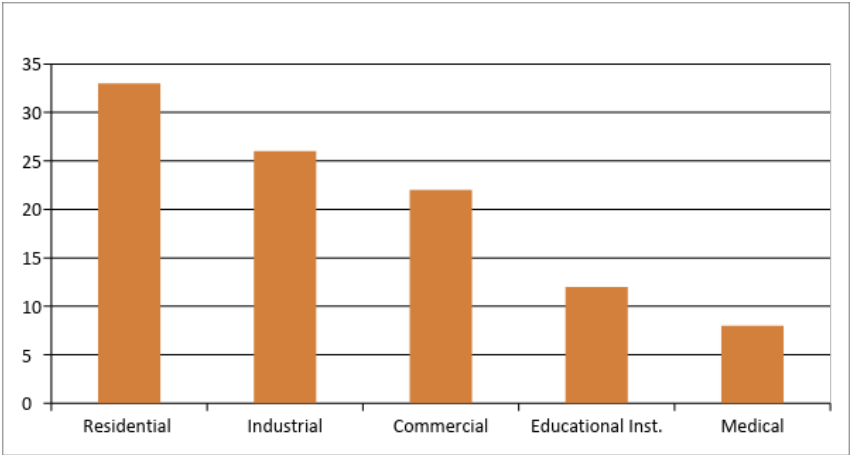


Figure 2 indicates, in order of decreasing percentage, that 33% of the owners get their recyclable plastic scraps from residents, 25% from industry, 22% from commercial outlets, 12% from educational institutions and 8% from medical institutions.

The next aspect the research delved into was the sorting and segregating of scraps that reaches the scrap shop. In the initial field study it has been observed that scrap shops do

not focus much on sorting of scrap because they require extra labour for it who need to be paid. With this in mind this question was addressed to the scrap owners during the survey. The statistical data are as follows:

Figure 3

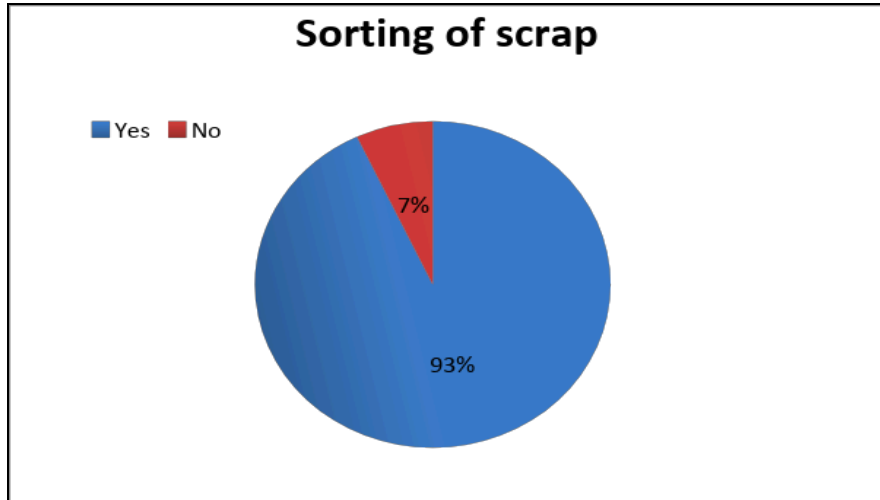


Figure 3 denotes an overwhelming tendency for scrap shop dealers to sort their waste, indicating that they do not merely store the collected plastic scraps.

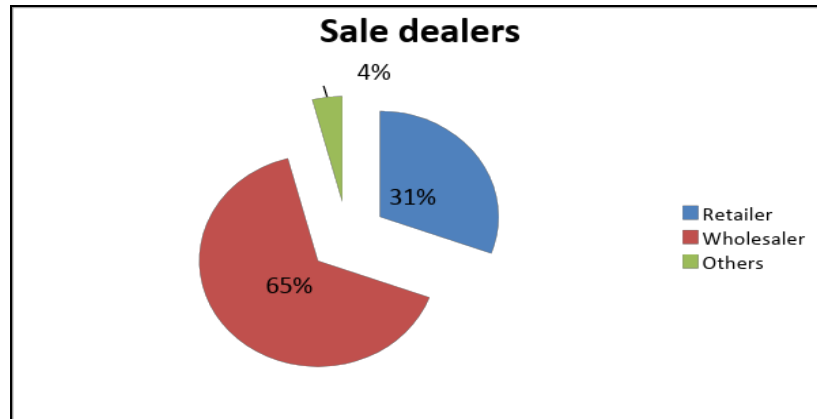
Table 2

Characteristic	Respondents	Percentage
High Density Polyethylene (HDPE)	31	33%
Low Density Polyethylene (LDPE)	28	30%
Polyethylene terephthalate (PET)	20	22%
Polypropylene (PP)	14	15%

This table covers the response of 93% of the respondents as 7% of the scrap shop dealers do not sort their plastic waste, choosing instead to sell it mixed. The reasons given for this choice was that they do not have sufficient funds to pay labourers for the sorting process nor do they deal with large quantities of waste. Among the 93% of respondents that do sort their waste, 33% of the owners deal with HDPE, 30% deal with LDPE, 22% with PET and 15% with PP.

The price for each category of plastic holds a different sales value: HDPE is sold for Rs.14/kg, LDPE for Rs.9/kg, PET for Rs.8/kg and PP for Rs.4/kg. Our survey also derived a detailed set of information regarding the sale of these plastic scraps, looking into types of buyers, quantities and frequency of sale. The following figure 4 reveals to whom scrap shop dealers primarily sell their plastic scraps.

Figure 4



It is clear from the above table that the majority (65%) of the plastic scraps are directed to wholesalers, while another significant portion (31%) is sold to retailers. The 4% sold to others includes, in some instances, the processors who collect the waste scrap directly from the scrap shop owners.

The following tables capture the frequency of sales of scrap to the respective dealers of the next level hierarchy.

Table 5

Characteristic	Respondents	Percentage
Once in a week	41	40.5%
Twice a week	35	34.5%
Alternative days	15	15%
Daily	10	10%

Table 5 gives a detailed sense of the frequency of sales. The majority of the scrap owners (40.5%) sell the plastic scraps on a weekly basis. Another large portion of them (34.5%) sell their scrap twice a day every week, while 15% sell theirs on alternate days and another 10% sell daily. The rationale behind the frequency, as explained to us during field research, was that it is based on the quantity amassed: larger quantities allowed more frequent sales and smaller quantities collected meant less frequent sales. This correlation becomes clearer in the following table which looks at quantities collected.

Table 6

Characteristic	Respondents	Percentage
Less than 250 kg	42	41.5%
250-500 kg	41	40.5%

500-750 kg	9	9%
More than 750 kg	7	7%

Table 6 captures how out of 101 respondents, there is a propensity to deal with smaller quantities: 41.5% of the owners sell less than 250 kilogram, 40.5% sell between 250-500 kilogram, while a significantly lower 9% sell 500-750 kilogram and 7% more than 750 kilogram. Combined data from the two tables and the correlation is clear: the majority of the respondents comprising 40.5% and 34% will necessarily have to wait for longer periods such as once or twice a week since the majority of them (40.5% and 41.5%) deal with 205-500kg and less.

Figure 5

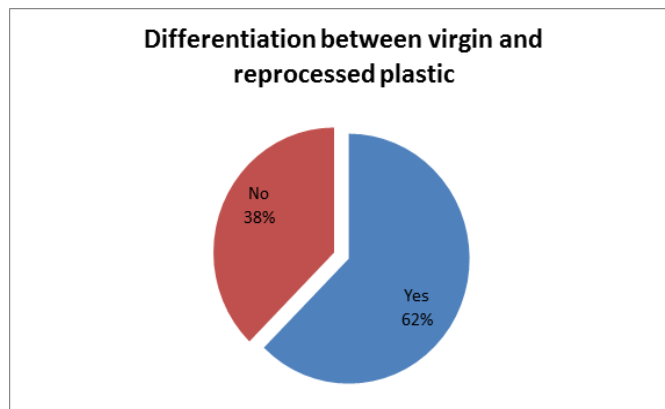


Figure 6

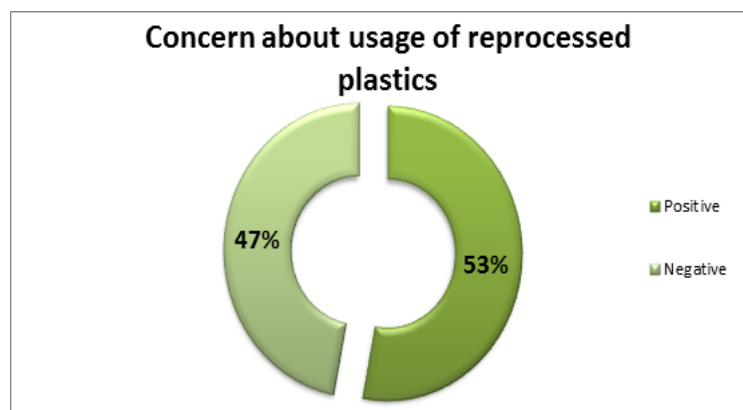


Figure 5 shows that 62% of the scrap owners believe they are able to differentiate between virgin plastic and reprocessed plastic by its texture and quality. With this in mind, the concern of the usage of virgin and reprocessed plastic were questioned in the survey. All the owners responded saying that use of virgin plastic is good and figure 6 represents that 53% responded that they have a positive perspective on usage of reprocessed plastic. Major reason behind this is that, as it has been a part of their

business, reprocessed plastics are more in quantity as scraps reach their business, without being aware that plastics are highly dangerous for usage as they don't decompose and also pollute the environment badly.

Further moving on, the research also looks at the expenses incurred by the scrap shop owners, at which the below Table 7 represents it. The major expenses which have been incurred by the owner in the scrap business are transportation of the scrap from the shop to the retailers or wholesalers in which 26% of the respondents are spending on transportation cost, 45% of the respondents spend on the wages for labourers, 87% of them on rent for the shop, where it is clearly understood only 13% of them are running their business in their own shop. 96% of them spend on electricity charges which are mandatory, whereas the remaining 5% were shops on the roadside and without electricity connection. 9% of them spend on storage because most of the respondents get less than 250 kilograms of scrap as has been mentioned in Table 6, which doesn't need a separate storage place.

Table 7

Expenses Incurred	Responses				Amount (approx.)
	YES		NO		
	Respondents	Percentage	Respondents	Percentage	
Transport	26	26%	75	74%	Rs. 4000
Labour	45	45%	56	55%	Rs. 8000
Rent	88	87%	13	13%	Rs. 3500
Electricity	96	95%	5	5%	Rs. 400
Storage	9	9%	92	91%	Rs. 1000

Figure 8

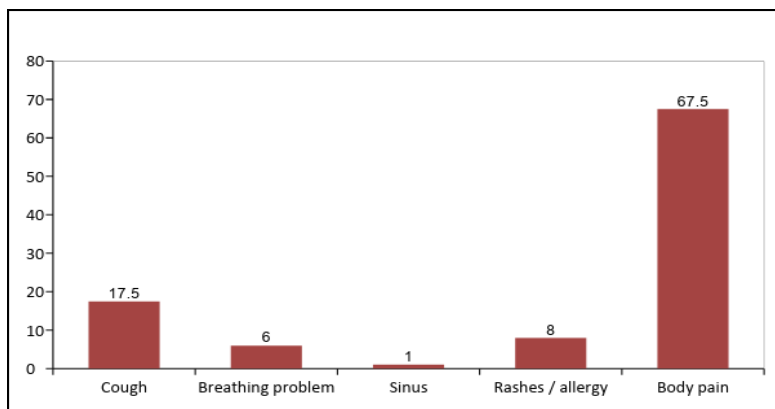


Figure 8 shows that, out of 101 respondents 67.5% of them are having body pain, 17.5% are experiencing coughs, 8% of them have allergies and rashes, 6% face difficulty in breathing and 1% have sinus. Most of them are unaware of it and do not take their health issues caused due to exposure seriously..

Further the data and information in the table and graph below represents the specific factors which were questioned among 53 labourers working in the scrap shop according to the availability of the resource.

Figure 9

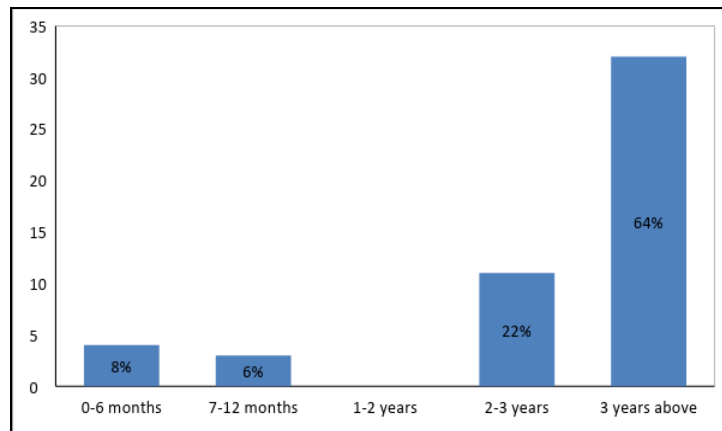


Figure 10

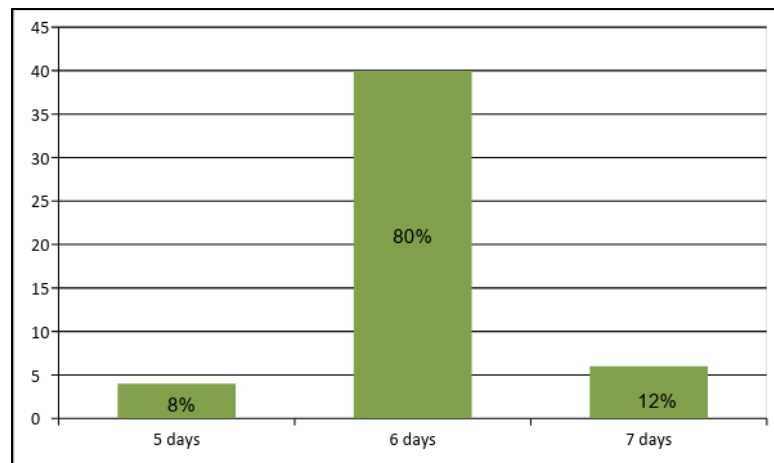
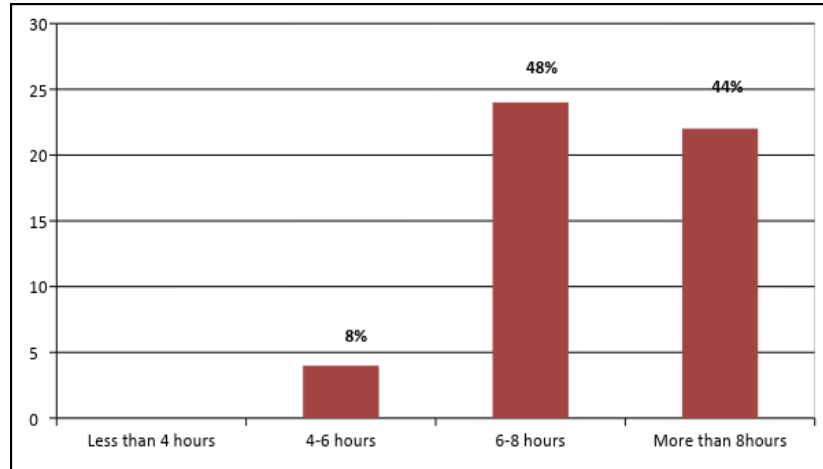


Figure 11



The above graphs represent the number of years of working in this business, working days in a week and the working hours in a day by the labourers. Figure 9, shows that out of 53 respondents, 64% of labourers are working for more than 3 years, 22% are working for 2-3 years, 8% of them are working between 0-6 months and 6% are of 7-12 months in the scrap shops for their income.

Figure 10 represents that 80% of the respondents are working for 6 days, 12% of them are working for 7 days and 8% of them are working for 5 days in a week. The results reveal that only on Sunday, most of the labourers are having their weekly off and in a few circumstances it may vary. Figure 11, gives a clear output that the maximum labourers of 48% from the survey have stated that they work for 6-8 hours, eventually 44% of them work for more than 8 hours and the rest 8% are working for 4-6 hours. The hours of working excludes the lunch break during which they go home if they reside nearby or if they are having lunch in the shop itself.

Table 8

Characteristic	Respondents	Percentage
Less than Rs.100	0	0%
Rs.101 – 200	9	17%
Rs.201 – 300	34	64%
Rs.300 and above	10	19%

Table 9

Characteristic	Respondents	Percentage
Daily	9	17.5%
Weekly	40	75%
Monthly	4	7.5%

Figure 12

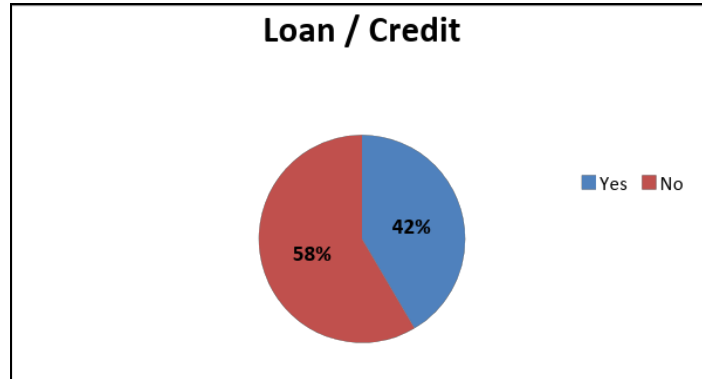
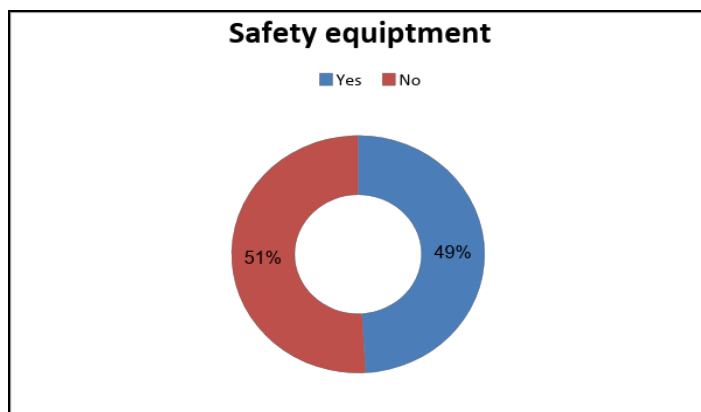


Table 8 contains the data on the wages paid to the labourers on per day value. Out of the 53 respondents, the majority of 64% earns around Rs.201-300, 19% are of more than Rs.300 and the rest 17% of Rs.100-200. None of the labourers earn less than Rs.100.

Also when it comes to the basis of salary they get table 9 represents that, 75% of the respondents get their salary on a weekly basis, 17.5% on daily and 7.5% on monthly. From the field study, it was understood that the labourers get weekly salary to meet their daily needs and necessity as they are from BPL background.

Figure 12 shows data on whether any sort of loan or credit had been provided by the owner in case of any emergencies or necessities. 58% of them have responded in the negative, that they don't get any sort of loan or credit assistance from the owner and the rest 42% get loan, but the reason for it as observed from the field study was that they have to meet sudden medical emergencies and sometimes for educational purposes.

Figure 13



The above figure 13 gives a graphical representation on the safety equipment i.e. gloves and mask which have been provided to the labourers who are dealing with

plastics on a daily basis. 51% of the respondents have said that they have not been provided with proper safety equipment at their workplace. Due to lack of safety, labourers face different sets of hurdles such as health issues and accidents during their work. Detailed data regarding the health issues are as follows.

Figure 14

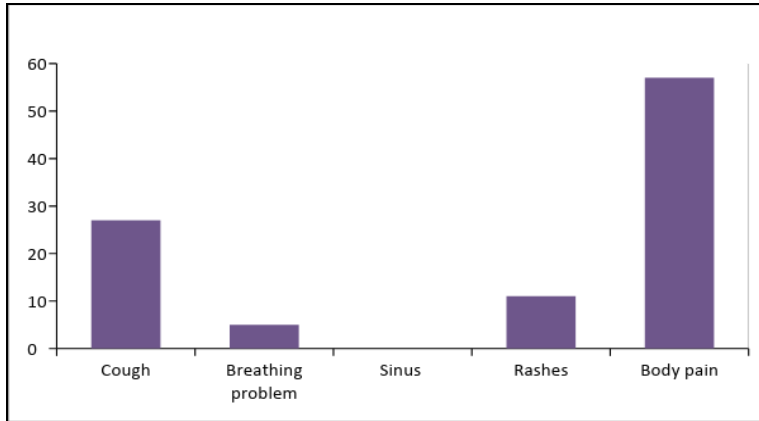


Figure 15

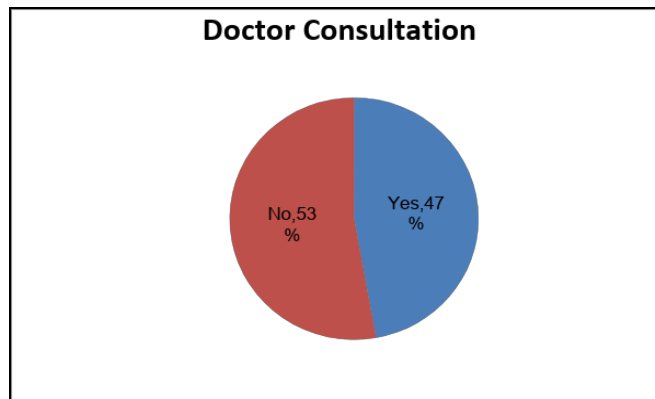
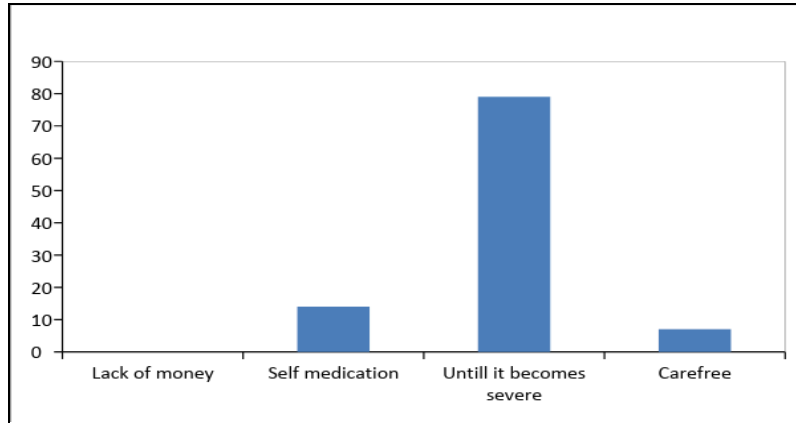


Figure 14 shows the health problems which are faced by the labourers, 57% of them are facing body pain as from the field study; these labourers carry loads of goods for uploading and downloading. 26.5% suffer from coughing, as they are not provided with proper safety equipment. 11% get rashes and allergies and the rest 5.5% suffer from breathing problems. Hence we set out to find whether they consult a doctor due to these health problems. Figure 15 represents that out of 53 respondents 53% of them do not consult a doctor. There are various reasons for being absorbed from the field study. But the major reasons were compiled and the data was collected in the survey. The finds are as follows in figure 16.

Figure 16



The graph represents that out of 53% who do not consult a doctor (n=28), 79% of the respondents do not go for doctor consultation as they feel it is not that severe, 14% of them do self-medication and 7% do not care much about consulting a doctor.

The table below represents the data on the following factors:

- (i) Accidents and injuries faced at work
- (ii) Working with medical waste
- (iii) Are the labourers are part of any trade unions

Table 10

Characteristics	Sub-features	Respondents	
		(n=53)	Percentage
Injuries / Accidents at workplace	Yes	43	81%
	No	10	19%
Working and dealing with medical waste	Yes	42	79%
	No	11	21%
Part of any trade union	Yes	2	4%
	No	51	96%

The table clearly explains that out of 53 labourers working in scrap shop, 81% of them have faced injuries and accidents in their workplace. From the field study it was learned that accidents and injuries occur when some sharp objects pricked or wounded the respondents when they work with scrap. In some cases even acids have been spilled because of the lack of safety measures as mentioned in figure 13. But among these 43 respondents, 93% of the labourers have responded saying that they get immediate assistance from the owner in these emergency cases.

Working with medical waste is more dangerous and hazardous for the labourer. But out of the 53 respondents, 79% of the labourers have agreed that they work with medical waste which is against the law in which states medical waste should not be recycled or reused. Working with medical waste without proper safety measures is even more harmful and creates health problems, and figure 14 represents that rashes and allergies have been experienced by 11% of the respondents, for which this could be one of the reasons.

The table also explains that the majority 96% of the labourers who are working in these scrap shops are not part of any trade unions or associations. From the field study, it was revealed that they are an informal set of labourers, where they are not formally recognised or considered as formal workers with proper benefits and system.

Qualitative analysis:

A qualitative study has been undertaken in this research, which provided an insight for the research to undertake a quantitative study as well. The scrap shops, which form the bottom part of the chain have not been formalised and lie in the informal zone, which helped us to develop ideas or hypotheses for potential quantitative research within the scrap shop owners and labourers. Qualitative research is used to uncover trends in thoughts and opinions, and dive deeper into the problem and with respect to this study it is to determine the different actors who are involved in different stages of the informal waste chain network and get in-depth details and information on the following factors.

- Health
- Economical value
- Living Condition and standard

Wherein the qualitative study consisted of the following methods as tools for the study:

- Semi structured interviews
- Observations
- In depth study

As part of the interview the following questions were asked in general to all the actors who were part of the waste value chain.

- In general to all the actors,
 1. How many years are you owning the business?
 2. Is this your only source of income?
 3. Has your business been registered and licensed?
 4. What are all the expenses incurred in your business?
 5. What are the challenges faced in your business?
 6. Who are the other actors involved in your business?

Brief discussion about the actors:

- Scrap shops

Scrap shops are the lowest level entity of the hierarchy, which collect scrap from different sources i.e. households, waste pickers, kabadiwalas, etc. They are the primary aggregators of the waste chain, who collect waste and sell to the next phase of the chain. The following questions were discussed with the scrap owners and labourers specifically.

- What are the different sources of waste you get at your shop?
- Are waste pickers involved in your source of waste?
- Does sorting of waste happen in your shop?

- **Retailers**

Retailers are the next level actors in the waste hierarchy chain. Collection of scrap material from scrap dealers and shops is the process that has been inculcated by them. Once it reaches a maximum quantity according to their storage capacity, the scrap is delivered to the wholesaler.

- **Wholesalers**

Wholesaler is the next actor in the waste chain. Bulk collection of waste scrap from retailers in a larger frame and sometimes directly from the source. Later it is segregated according to its types and categories. Sorted scrap is given to the respective processors who are in need of particular types or category. The following questions were asked in specification to the retailers as well as the wholesalers

- Does processing of waste happen?
- What is the maximum quantity of sales?
- Do you have a storage place?
- Do you sort waste according to the type and category?

- **Processors**

Processing of the sorted plastic waste according to the necessity of the manufacturers is the major work has been done at this phase. The types of processing are as follows:

Shredding - plastic scrap is shredded or ground in small chips like particles

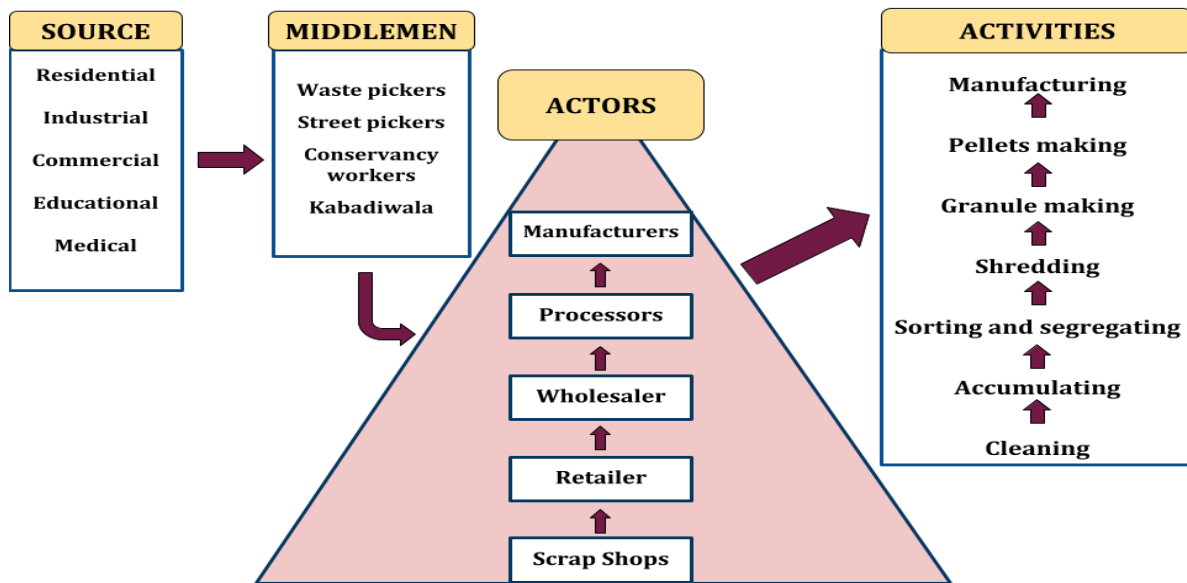
Pellets - these grinded chips are processed under high temperature and is made into small pellets like units which are moulded by its shape.

Granules - The granules are more or less similar to the pellets. But they differ in the processing part. hese granules are processed under high temperature and made into strings and later cut down into small granules.

The following set of questions were discussed with the processors to extract the information on several aspects.

- What are the different processing methods used in your business?
- Are you part of any trade unions or associations?

- Is any machinery used in the process?
 - What are your recurring and non-recurring expenses?
- **Manufacturers**
 Manufacturing units are seen as the last stage in the hierarchy of this study, since after the products have been manufactured, it then heads towards the sales entity. So the role of the manufacturer is to buy processed plastic recyclable materials from the processors and manufacture their products and goods. The following questions were posed to the manufactures to seek information.
 - Do you use only reprocessed plastics for production?
 - Do you use virgin plastic?
 - Are you part of any trade unions or associations?
 - What are your recurring and non-recurring expenses?



The above diagram represents the chain and structure of the waste economy system, which was determined on basic observations and interaction within the respective actors with the help of consecutive field visits. Also the flow of chain was aligned gradually from the lower level hierarchy i.e. the scrap shops to the higher level i.e. the manufacturers. The activities which have been inculcated in each phase have also been listed in the diagram, which was specifically observed and confirmed through semi structured interviews with the concerned representatives.

In context to health:

The health aspect of the labourers and owners of these particular businesses were enquired about their specific health problems and the measures they undertake. An in-depth discussion was carried on with each of them focusing on their health and causes. In the results, most of the labourers have responded saying that as they work

on the uncleaned scrap waste, shredding of this waste, producing plastic pellets and granules, it has various adverse impacts on their health.. In specific focus to the labourers working in these entities, they are indulged in the segregation being done where most of them are female employees. With them in focus, the basic health problems they face are allergies and rashes as they work with waste and also some suffer from sinus and breathing problems because the dust and effluents from the waste make them feel more uncomfortable. With respect to the male labourers, they work on loading and unloading the material by carrying it manually. Based on our interaction with them, most of these men suffer from severe body pain. Also when enquired about the medical facility and accessibility to the government hospitals, it was revealed that most of them take self medication from the local pharmacy for instant relief on a daily basis and when it becomes more severe they access the local nearby clinics for their remedy. Moreover the reason behind self medication was that they lose a day's wages if they need to go to a hospital. From the owners point of view, some of them do suffer from sinus and asthma since they are present on the premises during the work time which has an impact on their health.

In context to economic value:

Focusing on the wages been earned by the labourers in each phase of the hierarchy are as follows:

Labourers work place	Wages / per day
Scrap shop	200
Retail / wholesale entity	300
Processing unit	500
Manufacturing unit	600

The wages mentioned above are averagely assigned on the basis of inputs received from concerned actors during the interview. Moving further to the wholesalers and retailers, economical information about their purchase, sale and profit are as follows. The below table represents the price value of segregated recyclable plastic waste according to its type from a wholesale scrap shop in Ezhil Nagar, Kodungaiyur which is as follows:

S.No	Types	Rate bought	Rate sold
	Polypropylene - PP		
1	PP - White	Rs.19/kg	Rs. 38/kg
2	PP - Natural	Rs. 19/kg	Rs. 52/kg
3	PP - White second grade	Rs. 19/kg	Rs. 28/kg
4	PP - glass	Rs. 19/kg	Rs. 32/kg

5	PP - Colour	Rs. 19/kg	Rs. 32/kg
6	PP - Colour second grade	Rs. 19/kg	Rs. 16/kg
	High Density Polyethylene - HDPE		
7	HD - Colour	Rs. 19/kg	Rs. 26/kg
8	HD - Double super	Rs. 19/kg	Rs. 31/kg
9	HD - White	Rs. 19/kg	Rs. 27/kg
10	HD - Natural	Rs. 19/kg	Rs. 35/kg
11	HD - Blue can	Rs. 19/kg	Rs. 55/kg
12	HD - Tray	Rs. 19/kg	Rs. 45/kg
13	HD - Silk (kudam)	Rs. 19/kg	Rs. 43/kg
	Low Density Polyethylene - LDPE		
14	LDPE - Glucon	Rs. 19/kg	Rs. 45/kg
15	LDPE - Bottle cap	Rs. 19/kg	Rs. 60/kg
16	Polyethylene terephthalate - PET	Rs. 19/kg	Rs. 30/ kg

The above prices are listed on average, it may increase or decrease according to the demands of the particular type. The business has not been duly registered and runs basically under the category of cottage industry. At some instances, the wholesalers also own a shredding machine within the unit and shred the plastic taking it forward to the next process. Processing of recyclable plastics is the next phase of the waste chain network, wherein these processors have their own set of units and labourers working for daily wages and they are formally registered and are part of certain associations like Tamilnadu Plastic Manufacturing Association (TAPMA), Chennai Plastics Manufacturers & Merchants Association, etc. The following table represents the price value of processed material in a granule processing unit at Korukkupet.

S.No	Types	Rate bought	Rate sold	Difference
	Polypropylene - PP			
1	PP - White	Rs.30/kg	Rs.55/kg	Rs.25
2	PP - Natural	Rs.50/kg	Rs.70/kg	Rs.20

3	PP - Colour	Rs.28/kg	Rs.45/kg	Rs.13
	High Density Polyethylene - HDPE			
4	Colour	Rs.35/kg	Rs.55/kg	Rs.20
5	Natural	Rs.42/kg	Rs.60/kg	Rs.18

The differences also include other processing cost on average which as follows:

- Labour - Rs.3/ per kg
- Electricity Charges - Rs.3/ per kg
- Wastage - Rs.5/ per kg (differs from each product)

The above prices are mentioned averagely, and it may differ according to certain factors such as demand, price inflation and labourers, wherein the owners averagely gain a profit of Rs.5 per kilogram. In addition they have invested in certain machineries in the unit for processing the waste, where the shredded chips are converted into granules. So once the granules are processed it is sent to the last phase i.e. the manufacturing of new products from the reprocessed material.

From the field study, the owner of Chennai Plastics provided information on the different methods of plastic production and its grades are domestic and engineering. Domestic is the plastic items which are made and recycled to make household articles. Engineering refers to all the small appliances and electronic goods which are made out of plastic. The units or dealers who deal with the engineering products are formally licensed and the domestic dealers are not exactly licensed, because most of them are labelled as cottage industry. The three main grades of domestic goods are blow grade, injection grade, and film grade. A plastic manufacturing unit has a specific dye on blowing unprocessed plastics granules are considered below grade (example: kudam or pot). A manufacturing unit that has a dye of injecting a particular mould is termed to be an injection grade product (example: bucket, mug, containers, plastic toys, etc.). A unit that holds a specific dye that produces thinner plastic products are termed to be under film grade (example: plastic covers).

In context to living standard and condition:

Labourers who work in the scrap shop are more or less the residents who reside in the same locality. This in turn helps them to be more comfortable in getting to work and also from our interaction we came to know that they go back home for lunch for an hour, where this helps them even to complete some of their household work as well. Focusing on the living standard, these community people live as a lower middle income group, which is basically categorised based on their incomes. They plan and schedule their day expenses based on their daily wage. With respect to the owners, more or less they also live in the same locality or just a few metres away from the entity. They live on the basis of this business and take up profit according to their work. They also lie in the middle income group category.

Through this qualitative study, at each point of stage and phase of the waste chain hierarchy, with in-depth discussions and interviews with concerned and relevant persons data has been gathered. Some of the major findings in common have been listed below.

- In the waste value chain hierarchy three fourths of the stage are informal ways of business which are functioning and the lower level part of the chain are more vulnerable.
- From the bottom level to the middle level of the stage people's working conditions have not been recognized formally and have been working informally without a proper mode of employment.
- On average, around five to seven middlemen are involved in the overall process of the stages from the collection of scrap plastic waste till the manufacturing of new products.
- In addition, the manufacturers are also producing certain products from virgin plastics as well. Virgin plastics are being sold in the markets for production and manufacturing of new plastic goods.
- Certain actors who are in the middle level have registered themselves in local area associations for their benefit and security.

Recommendations

1. **Types and rates of plastics.** Our findings clearly indicate that there are certain types of plastics favoured over others. Furthermore we have detailed information of the value of the three most sought after plastics as well as the variation of price within these categories of plastics. This kind of research can be used by policy makers and further built upon to encourage industries, through a set of incentives and deterrents focused on types of plastics and their viability for recycling, to streamline the kind of plastic used for production. Elimination of the kind of plastic can rely on those that have little to no value to waste pickers. This will lead to a more sustainable life-cycle of products.
2. **Quantities.** A significant majority of scrap shop owners deal with small quantities of plastic scraps. This could be a major deterrent for industries to source plastics from the informal sector since it would require far too much coordination with several small shops. The convenience of bulk buying virgin plastic is preferred despite the fact that it comes at a higher cost than reprocessed plastics. The government should look for ways to organise these scrap shops, looking into successful case stories or opting for a cooperative model or industries themselves would benefit monetarily if they were to create a system that could maximise the potential in the informal waste economy.
3. **Medical waste.** Despite the government coming out with Bio-medical Waste Management Rules, 2016, an updated set of rules specifically focused on medical waste, the care taken to isolate and mitigate the repercussions of improper medical waste management is appalling. Our research revealed that plastic scraps derived from medical institutions is an actual stream for the informal waste economy and that a considerable majority (79%) of workers are

engaged in sorting, cleaning and segregating medical waste. There should be tighter checks and proper alternative systems in place so that this trend is discontinued.

4. **Health Checkups.** Given the kind of conditions of work and health hazards the informal waste workers, specifically waste pickers, face, the SWM Rules, 2016 should include regular health checkups for them. Alternatively, NGOs working closely with waste pickers should definitely make health camps a regular feature of their work. The recommendation for such a proactive step is because our research shows that an overwhelming majority postpone their visit to receive a doctor or hospital despite a host of ailments and issues. They delay receiving medical attention until they reach a critical point.
5. **Trade unions.** Our research revealed that 96% of the labourers working in scrap shops are not part of any trade union. We believe that organising trade unions for actors in the bottom of the chain--waste pickers and labourers-- will be instrumental in them demanding better living and working standards. It is not a coincidence that the places where the informal waste economy is thriving such as in Pune is thanks to their trade union Kagad Kach, Patra Kashtakari Panchayat's efforts.