

Article Title: Creating Synergy between Environment and Employment: A Case study of Plastic Recycling Industry in Dharavi, Mumbai

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Abstract

Environment related work, viz., monitoring, analysis, surveying, sustainable harvesting, eco-friendly product making etc. have individually emerged as 'environment industry.' However, in India, this remains largely unorganized.

The present study is an attempt to explore the dynamics and challenges faced by the plastic waste recycling industry housed at Dharavi, the infamous slums of Mumbai. Various challenges are associated with the waste recycling industries - inadequate institutional facilities to deal with the problem arising out of shortage of expertise, financial resources, and legal and administrative enforcement of environmental regulations, many of which do not conform to the need of the time are some of them. Coupled with this is the lack of public awareness and environmental ethics that results in uncontrolled solid waste disposal. Part of the financial deficit is the insufficient fee structure.

This study attempted to understand the process, entrepreneurial challenges and opportunities, and employee wage structure of plastic waste recycling. The study revealed the appalling work conditions and fragile finances of the entrepreneurs and workers engaged in plastic waste recycling.

Although designated as a large, congested slum in the heart of the city of Mumbai, Dharavi is much more than a mere slum. It is a thriving hub of as many as 10-15 thousand small-scale industrial units including waste recycling, pottery, leather tanning, shoemaking, textile and bakery. The present study adopted a focus group-based approach to garner relevant data about the plastic waste recycling industries located in Dharavi, with special stress on the various challenges faced by the human resource involved.

Keywords: MSME. Waste Recycling Industry. Socio-economic Challenges. Dharavi.

1. Introduction

The term environmental industry was defined in 1988 by Environmental Business International Inc.(EBI) as all revenue generation associated with environmental protection, assessment, compliance with environmental regulations, pollution control, waste management, remediation of contaminated property and the provision and delivery of environmental resources (EBI report 2020, 1988). The Environment industry in the USA is rather organized, with total revenues of more than \$315 billion in 2010, generated by about 30,000 private sector companies and more than 80,000 public sector entities in the United States, employing 1,657,300 Americans (US Census Bureau report, 2012).

However, such is not the case in India, where the environment industry remains largely unorganized, and mostly covered under the heading of the Micro, Small and Medium Enterprises (MSMEs). So much so, that the keyword ‘Environment Industry’ is still unfamiliar in India. Hence, to gain an insight into the synergy between environment and employment in India, it is vastly important to understand the MSMEs.

The Micro, Small and Medium Enterprises (MSMEs) represent the largest proportion of the manufacturing sector and play a key role in economic development in India. Idris and Rahman (2009) pointed out that Small and Medium Enterprises have always taken front seat for young entrepreneurs to start their businesses. According to the Union Ministry in India, 95 % of industrial units are in the small-scale sector with 40 % value addition in the manufacturing sector and 8 % contribution to the Indian GDP. According to one estimate in terms of value, the MSME sector accounts for about 45% of the manufacturing output, and 40% of the total export (www.msme.gov.in). This sector is the second largest employer after agriculture (Report by IIA & MCCIA) and employs an estimated 59.7 million persons spread over 26.1 million enterprises.

This article has been organized thus – the Introduction section defines the MSMEs, describes the international scenario, discusses their objectives, socio-economic significance, challenges faced and the role played by the Indian government. The second section is dedicated to describing the Recycling Industry in India and the potential of entrepreneurial activities in this sector. This section concludes by delineating the need for the study. The third section describes in detail the study area and the survey methodology. Results and discussion have been detailed in the fourth section. The fifth section is comprised of the Conclusion and future scope of work while the last section contains the authors’ recommendations.

a. International Scenario

Hodgetts and Kuratko (1995) suggest that small businesses create employment. These are the economic engines driving the global quality of life (Hills 1995). Indeed, small firms constitute the bulk of enterprises in all economies in the world. Undoubtedly, small firms and

entrepreneurship play a major role in the world economy (Bygrave 1994). MSMEs, by number, dominate the world business stage. Although precise, up-to-date data are difficult to obtain, according to one estimation it is suggested that more than 95% of enterprises across the world are MSMEs (Ayyagari et al. 2011).

Zimmer and Scarborough (1994) asserted that this century would begin with the greatest number of small businesses. Over the last two decades, new MSMEs have been identified by governments in several countries as significant components of economic growth in terms of job and wealth creation. This contention is strongly supported by the work of Holmund and Kock (1998), Kuratko and Hodgetts (1995), Hodgetts and Kuratko (1995) and Birley and Westhead (1989).

Rodriguez et al. (2007) reported some 23 million medium and small enterprises providing around 75 million jobs and representing 99 % of all enterprises in the European Union (EU). MSMEs thus play a central role in the European economy. In most of the developing world, MSMEs are the only realistic employment opportunity for millions of impoverished communities. According to Lozzi (2008), MSMEs occupy the place of strategic importance in Jordanian economy due to their considerable contribution in terms of production, sales and development. It accounts for 50% of the total manufacturing sectors, has 20% share in export, provides 80% of employment in industrial sectors and contributes about 8.5% to the GDP (Lozzi, 2008). In Malaysia, the MSMEs have contributed about 21% to GDP. Department of Statistics (DOS) has established in 2005 that 96.5 % of the establishments in the manufacturing sector were MSMEs.

Japan has recorded the highest proportion of MSMEs among the industrialized countries, accounting for more than 99% of total enterprises (EIU 2010). India, as per the Ministry of Micro, Small and Medium Enterprises, recorded 13 million MSMEs in 2008, equivalent to 80% of all the country's businesses (Ghatak 2010). In South Africa, it is estimated that 91% of the formal business entities are SMEs (Abor and Quartey 2010). The Singapore government announced a series of support measures to help its 145,000 small and medium enterprises to restructure and design better jobs as the city state transition into a higher productivity economy. The government is working towards creating a more favourable business environment by simplifying assistance schemes for SMEs and enhancing the existing Enterprise Development Centres (EDCs) into one-stop shops. The SME sector is an important pillar of Singapore's economy. They contribute more than 50 per cent of economic output and 70 per cent of employment.

Most OECD governments promote entrepreneurship and seek to support and develop MSMEs through a myriad of policies and programs. These attempt combat many common

difficulties encountered by MSMEs and offer solutions to problems in such areas like finance, technology, innovation, IT, management, internationalisation etc (Rodriguez et.al. 2007).

b. The Major Objectives of Developing and Nurturing MSMEs in India

The small scale industries have been growing during the last three decades on account of their significant role in attaining the major objectives that are as under:

- Removal of economic backwardness of the rural people and underdeveloped segments in the country as a whole.
- Attainment of self-reliance.
- Reduction of regional imbalance.
- Reduction in disparities in income, wealth, consumption & standards and facilitation of mobilisation of resources, capital and skills and optimum utilisation.
- Create large employment opportunities and raise levels of output, income and standard of living.

For a developing country like India, the growth of small scale industries is of great significance and their nurturing and development must be fostered by all round efforts, so that a new class of talented entrepreneurs endowed with their initiatives and enterprises become an economic force to reckon with in this country.

c. Economic Importance of MSMEs

The MSMEs sector continues to remain an integral part of the Indian economy with significant contribution to GDP, industrial production and employment generation in India . The major advantage of this sector is its employment potential at low capital cost. The labour intensity of this sector is much higher than that of the large enterprises. They are often termed as 'engines of job creation'. The small-scale industrial sector has recorded a high growth rate since independence in spite of stiff competition from the large sector and not so encouraging support from the government. This is evidenced by the number of registered units, which went up from a mere 16,000 units in 1950 to 36,000 units in 1961 and to 133.67 lakh units in 2007-08.

As far as the output of the SSI unit is concerned, it was Rs.1,22,154 crore in 1994-95 which has considerably risen to Rs. 695126 crore in 2007-2008 (at current prices). Production in SSI sector during the last ten years has recorded an annual average growth rate of 8.6 percent. The share of SSI in the country's industrial output is around 39 percent . SSI Sector plays a major role in India's present export performance. 45% to 50% of the Indian export is being contributed by the SSI sector. Direct exports from the SSI sector account for nearly 35% of total exports. India itself has a savings rate of 30 per cent of GDP, and this once touched 37 per cent. It is contributed mainly by households and unincorporated businesses. Foreign direct investment in India is barely 1-2 per cent of GDP. This links India to global markets and technology, and so

is disproportionately useful. However, it is not the crucial driver of growth - it has to be local investment. Above all, it has to be investment by small and medium enterprise. This lesson is driven by R Vaidyanathan's book 'India Un inc'. He estimates that the share of the private corporate sector in GDP is under 18 per cent, while that of the non-corporate sector is 45 per cent. The share of the non-corporate sector is 64.6 per cent in construction, 74.2 per cent in trade and hotels, 81.4 per cent in transport (excluding railways), 51.6 per cent in storage and 60.8 per cent in real estate (Swaminathan A.).

d. Role of the Indian Government

Madhoun & Analoui (2004) contend that Micro and Small Enterprises (SMEs) occupy an important and strategic place in the economy of a country as they contribute significantly to wealth and employment. All the foretasted benefits of Small and Medium Scale Enterprises cannot be achieved without the direct intervention of the government. Over the years, a number of Market Entry Strategies have been formulated by the government of India with a view to developing Small and Medium Scale Enterprises.

The Government policy framework right from the First plan has highlighted the need for developing the SSI sector because of its strategic importance in the overall economic development of India. The policy support from the Government towards Small Scale Industries has tended to be conducive and favourable to the development of small entrepreneurial class. Government is implementing suitable policies and promotional schemes for MSMEs development.

Public sector banks offer a range of services and schemes including loans and credit facilities for various business needs. Some of these are National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation Limited (NSIC), Small Industries Development Bank of India (SIDBI), National Commission for Enterprises in the Unorganized Sector (NCEUS), and Rural and Women Entrepreneurship Development (RWED).

e. Problems and Challenges Faced by MSMEs in India

Rakesh Mohan (2012) discusses that "capital costs of this industry is typically high because of market imperfections in the availability of information for investors and lenders." Apart from financial problem, there is scarcity of technical skill and managerial ability in this sector. The organizers and artisans of the small enterprises lack proper knowledge of the modern technology and marketing conditions. In spite of their originality, products are not often standardized and therefore, not getting economies of scale and are not exposed to advertisement. While large scale industries enjoy the economics of scale. Inadequate technical and managerial guidance and non-availability of industrial space have been outlined as significant challenges by Velsamy (2012). Also, these industries are largely unorganized and

suffer due to the absence of a proper network. They are mostly labour-intensive with a marked lack of machinery (Mohan 2012).

Inadequate attention and sympathy of the Indian political class may be also outlined as a challenge. A TOI report (2014) penned by Swaminathan Iyer outlines how the Indian political scenario misses the point of nurturing MSMEs by being more intent on creating ever more industrial parks and corridors.

Lack of print and other media attention is another aspect. The services sector has been the biggest driver of fast growth in the last two decades, but not mainly because of giant software or BPO companies - two-thirds of services growth has come from the non-corporate sector. Yet the corporate sector -including foreign companies -gets all the glamour, headlines and VIP treatment. It gets easy access to credit and equity finance while small and medium enterprises are starved (Economic liberalisation, Times of India 21st September,2014).

2. Recycling Industry: A Small Scale Enterprise

a. Overview

Waste recycling involves the processes of waste collection, transportation, sorting, processing and final disposal (Visvanathan and Trankler 2003). Scientific technologies and socio-economic planning are necessary at each step. However, the recycling industry in India remains largely unorganized still. In fact, authors have reported it to be highly chaotic and unscientific (Gupta et al. 1998). There is almost no on-the-spot waste segregation – degradable as well as recyclable waste is disposed of in dustbins or roadsides. From here, the recyclable waste is collected by rag pickers, and sold to dealers. From here, waste finds its way to various processing units where saleable items are fashioned out of the waste. Recycling reduces operating and transport costs, emissions; creates green jobs, substitutes virgin materials and yields economic benefits.

Recycling takes place majorly in mega cities which needs to be taken to small towns and cities. Informal sector recycles 70% of plastic waste and up to 56% of all recyclable waste. Various challenges are associated with the waste recycling industries - inadequate institutional facilities to deal with the problem arising out of shortage of expertise, financial resources legal and administrative enforcement of environmental regulations, many of which do not conform to the need of the time are some of them. Coupled with this is the lack of public awareness and environmental ethics that results in uncontrolled solid waste disposal. Part of the financial deficit is the insufficient fee structure.

Beukering et al. (1999) crystallize these challenges as:

- Inadequate municipal services due to limited resources;
- An absence of hygienic and scientific disposal systems;
- A lack of public awareness for waste management resulting in high levels of unsegregated waste

- Generation and littering;
- The existence of an extensive informal network which is mainly driven by market forces and functions partly on subsistence levels;
- The absence of sufficient capacity for waste processing, in particular for organic waste which is in most abundance;
- The existence of a relatively small market for recycled waste products. Although this sector is highly informal, it is still thriving owing to vast and easy availability of the raw material, i.e., waste and a large market for the cheaper recycled goods (Ref). Recycling of wastes has increased from 10 to 22% since 1990 to 1998 in the Asia Pacific region (UN, 2000).

b. Solid Waste Management through plastic recycling

Recycling of plastic waste in India is mostly undertaken by the informal sector. The formal recycling set-up in India is a minor fraction and is only in its initial stages, experimenting different models. Informal recycling in India is a consequence of the increased gap in waste service provision (16) and the resultant ease of access to secondary raw materials which have immediate economic value.

The chain of informal sector in plastic recycling industry comprises of waste pickers (WPs), travelling waste buyers, dealers and recycling units. WPs includes maximum number of people employed including child constitute the largest population in the informal sector.

Normally, recyclables are collected in two ways like paper, glass and metal are collected before they enter the MSW stream from households for which they (kabariwala) get instant payment, by a special group of people called 'Kabariwala' (travelling waste buyers) and plastics are generally collected by waste-pickers from litter on streets or from heaps of waste in landfills. Shopkeepers sell recyclable items, such as newspaper, cardboard, glass containers, tin cans etc. to itinerant waste buyers too. Waste pickers retrieve recyclable materials like milk bags, plastic cups and containers, glass, etc from what is discarded by households, commercial establishments and industries.

c. Entrepreneurial opportunities in Recycling Industries

In developing countries like India, there are ample opportunities for innovation, exploitation of the available resources and initiation of entrepreneurial ventures through recycling units. The field of entrepreneurship, in recent past, has witnessed much diversification and creativity. Entrepreneurs are found in such widely diverse fields as education, biotechnology, media, agriculture, public services, social work, ecology and environment, service sectors and even in research activities. Recycling industries are also emerging as good entrepreneurial opportunities.

“Entrepreneurs are simply those who understand that there is little difference between obstacle and opportunity and are able to turn both to their advantage”.

d. Need for the Study

The unorganized or informal sector constitutes a pivotal part of the Indian economy. More than 90% of workforce and about 50% of the national product are accounted for by the informal economy. Considering this, it is imperative that formal data collection regarding the challenges and travails of the small-scale industries is taken up from time-to-time. Also, keeping in mind that the small-scale industries vary widely in nature, a case study-based approach that avoids generalisations and contributes to the database is distinctly indicated. With these aspects in mind, the present paper follows a case study-based approach in which the solid waste sorting and recycling industry centred at Dharavi, Mumbai has been targeted to assess the various challenges faced by this sector.

Dharavi has been described by many as Asia's largest slum (Sharma 2000, Apte 2011) with the metropolis of Mumbai often being called Slumbai or Slumbay with the largest number of slum dwellers in the world (over six million). Despite being of immense economic importance, Dharavi is probably like an iceberg only the tip of which has been explored up till now and which must be investigated in thorough detail.

3. Material and Methods

3.1 Study Area – Geographical, Socio-Economic and Historical Details

The slums of Dharavi in Mumbai have earned the dubious distinction of being one of the largest slums in the world (Sharma 2000). Apte (2011) describes it as Asia's largest and the world's second-largest slum. Dharavi, however, is not a slum but a unique self-contained township.

Here, a large native and migrant population live and work in the same region.

a. Geographical Details

Geographically, Dharavi spreads across 175 ha (1.7 sq km) government-owned land right in the heart of the Mumbai city with Mahim in the west and Sion in the east (**Figure -1**). It is one of the most densely populated regions with estimates ranging from 600-2000 people/acre. Various significant details of Dharavi have been summarized in **Table 1**.



Table 1: Dharavi: Salient Features

Name	Dharavi
Global Coordinates	Latitude: 19°00'51" N Longitude: 72°50'52" E
Elevation	12m/39ft
Land Ownership	Municipal Corporation of Greater Mumbai
Municipal Wards	H(E), G(N)
Area	1.7 sq km/200 hectares/500 acre
Population Estimate	300,000 to about 1 million
Population Density Estimate	600 to 2,000 people per acre
Mean tenement size	100 sq ft
No. of individuals per toilet	1440

Languages spoken	Marathi, Hindi, Tamil
Religions	Hindu, Muslim, Christians

b. History

The slums of Dharavi trace their history way back to the 18th century when Dharavi was a marshy wasteland and local kolis inhabited the land. Locals report that the first house was built in Dharavi in 1840. However, with the seven islands of the peninsula merging to give birth to the Bombay city as we know it today caused the filling up of the marshy lands and ousting of the kolis. Instead, here came the pottery-makers of Saurashtra, the Muslim zari embroidery-making workers from UP, the *chambhars* or leather goods makers of Maharashtra and the workers from Tamil Nadu to work in the tanneries. In those days, the locality of Dharavi was relatively much more spacious and greener than it is now.

c. Socio-economic & Demographic Aspects

The Oxford dictionary describes the word ‘slum’ as “a squalid and overcrowded urban street or district inhabited by very poor people.” Considering this, Dharavi is a slum in every sense of the word with squalid, sunless 100 sq ft corrugated tin-roof settlements for eight-member families, open drains, the lack of toilets and extremely difficult and inhuman living conditions that one observes here not being hidden from anyone. Also, the residents of Dharavi are unauthorized, with no legal dwellers.

Population in Dharavi is approximately more than 1 million. It occupies 1.75 hectars which is equal to approx 432 acres. The density population is 5,70,000 per sq.km which is 20 times more than that in Mumbai.(Manie 2013).

Dharavi has two sections – residential and commercial. The commercial section has about 10-15 thousand single-room industrial units involved in solid waste recycling, machine spare part making, leather tanning, shoe-making, textile dyeing, stitching, embroidery, block-printing, pottery-making and baking among others. It is reported that the annual turnover from these industries is as much as \$650 million dollars (Bansal and Gandhi, 2012). Many of the products formulated here sold in the native markets and also exported worldwide. 85% workers have a job in the slum and work locally.

More than a slum, Dharavi may be described as an inter-city township (Patel and Arputham 2008), which sustains itself with little or no outside support. In fact, it has a distinct feeling of village-like community living. There are informal shopping centres, restaurants, cyber cafes, MCGM-run primary school, temples, mosques and churches. The pottery area located in the Dharavi slums is a community centre.

One of the most unusual industries to have found its way inside Dharavi is the tourism industry, with slum tours or reality tours gaining immense popularity post *Slumdog Millionaires* (Dyson 2012, Bansal and Gandhi 2012).

Several of the workers employed in Dharavi are second-generation residents with their fathers or grandfathers being the original settlers while some are recent migrants. Several of the businessmen have accrued sufficient wealth to move out to more uptown residents, but their businesses continue to be based out of Dharavi. Also remarkable are a group of entrepreneurs who were never the residents of Dharavi, but were nevertheless attracted by the prospect of cheap labour and rent here to operate their business units with higher profit margins.

d. Survey Details

The study is based on focus group discussion. A focus group is an in-depth, open-ended group discussion of 1 to 2 hours' duration that explores a specific set of issues on a predefined topic. Such groups consist typically of between six to eight participants and are arranged under the guidance of a facilitator. Focus group studies entail the targeting of a group of people and asking them about their perceptions, opinions, beliefs, and attitudes. The survey was conducted during the month of August 2014. Here, groups of plastic recycling industry owners and workers were targeted. Group size ranged from 5-10. The questionnaire used in the study has been attached as a supplementary file.

4. Results and Discussion

The study involved a total of 10 groups of average size 8. It was reported that Dharavi has about 1200 units of waste recycling, of which 780 were of plastic recycling. Since this was a large chunk of the total, and reliable data for other types of waste was difficult to get, the present study focussed on plastic recycling units.

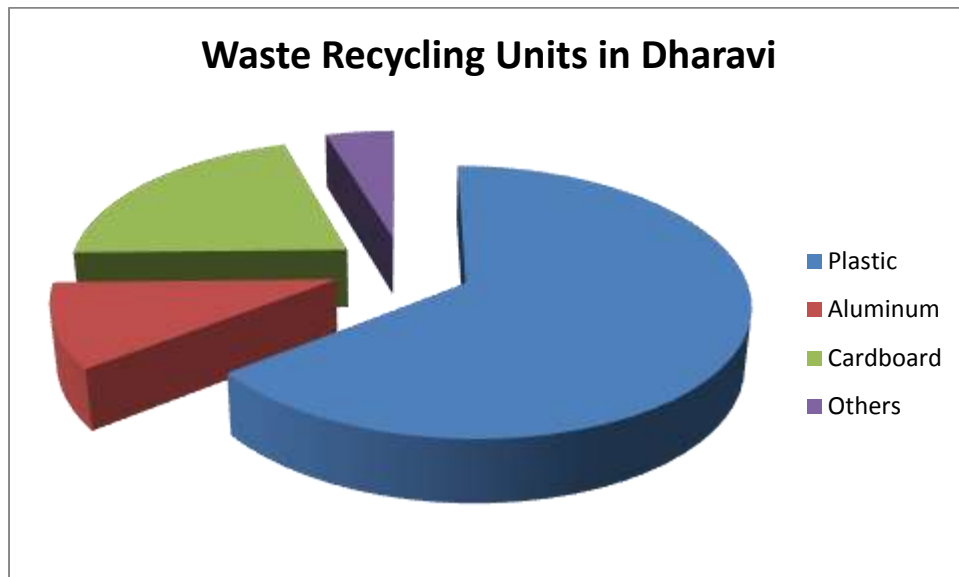
a. Waste Recycling Units: Procedural Details

Dharavi houses one of the largest recycling industries in India. An estimated 20% of its inhabitants work on different aspects of waste processing. Waste recycling units in Dharavi have an informal supply and delivery chain with local rag-pickers at one end and large industrial units at the other. All the work is done manually, with women being employed in some areas. According to the Mumbai Metropolitan Regional Development Authority (MMRDA), Mumbai residents generate 11,209 tonnes of waste a day, and the vast majority comes to Dharavi, where it is sorted and processed. On average, each waste-picker sorts through 8.5 tonnes of rubbish each day. As much as 80% waste in Mumbai is recycled, as compared to 23% in the United Kingdom.

Approximately 1200 waste recycling industries exist in Dharavi. Of these as many as 780 units were those of plastic recycling (**Figure 4**), others being that of aluminium, cardboard box and paper recycling and a few units of glass crushing. Raw material for these units is obtained

not only from the local rag-pickers but also from all over India. Nearly 70% units were found to be unregistered. Leather goods were repaired in Dharavi, but their recycling was not reported as such. Glass waste was collected and crushed in a few units in Dharavi, but was sent out of Dharavi to other units elsewhere for melting. Wood recycling units were not reported.

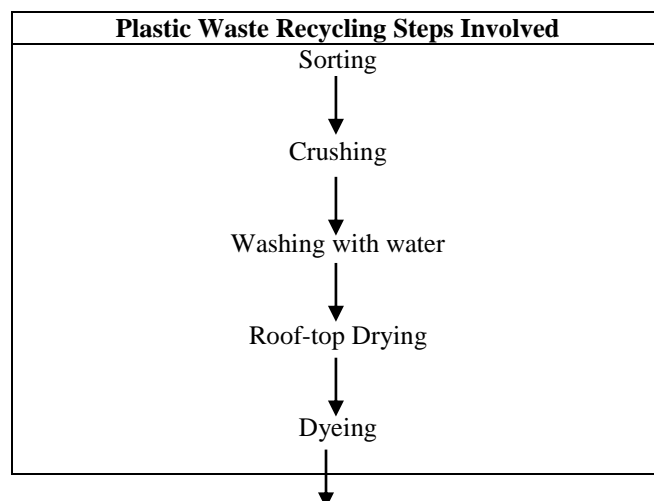
Figure 4: Types of Waste Recycling Units in Dharavi



Details of plastic waste recycling process have been provided in **Table 2**.

Plastic recycling process is partially carried out in Dharavi. It employs the sourcing of plastic waste locally and from other states of India and its sorting. After sorting, waste is cleaned and dried on roof-tops. Post this, waste is crushed in an electricity-run crushing machine and dyed. Same-coloured plastic is then converted into pellets. These pellets are sold out of Dharavi for further processing.

Table 2: Flow-chart of Plastic Waste Recycling



Pellet-making



Table 3: Economic Details of Plastic Waste Recycling Units in Dharavi

Details	Plastic
Amount handled per month	15-20 tons/month
Cost of recycling/kg	INR 20/kg
Selling price/kg	INR 70/kg
Annual Turnover	INR 10-25 lakh/annum
Annual Savings	INR 1,20,000 – 3,00,000 per annum
Number of Permanent Workers	2-8
Number of Contractual Workers	8-10 (when required)

Of these, waste was collected by rag pickers, the processing was done by permanent or contractual employees, and then the pellets were sold to other industries as raw material.

The chief investment made by the entrepreneurs in this line is in the purchase of the building that houses the unit and the plastic crushing machine. The former is in the range of INR 3,00,000-5,00,000 while the latter costs about INR 75,000-1,00,000. In addition, the entrepreneur pays a monthly rent to the Municipal Corporation of Greater Mumbai (MCGM) to the tune of INR 1200/-. The process costs of recycling plastic comes to INR 20/kg.

b. Socio-economic Details

Primarily, most of the business owners of recycling units were Muslims. Several owners reported that this business is run by his family from last three generation and they are residents of Dharavi while others were from outside, who had got industrial units at Dharavi due to cheap availability of resources. However, many owners had shifted their residential outside Dharavi where living conditions are better, while retaining their industrial units.

i. Wage Structure

After discussion with different groups / owners of recycling industries, it is concluded that male workers were paid INR 200-300/day. Normally, male workers worked for about 10-12 hours/day for six days a week. Their average age was reported around 25.6 years. Workers were mostly observed to be migrants from Uttar Pradesh and Bihar. Workers were mostly illiterate to barely literate and came from extremely poor families. Almost all workers had migrated singly, leaving their families in their native places. After working 8 to 9 months and collecting some amount of money these workers went back to their homes and came back after 3 to 4 months. The health condition of these workers reported was not satisfactory.

Table 6: Socio-economic Details of Workers

Average Age	20-25
Religion	Muslim, Hindu
Literacy Level	Primary Education
Nativity	UP, Bihar
Number of working hours	8-10
Number of days/week	6
Wages	200-300/day
Savings	3000-4000/month
Chief Expenditure	In Health
Personnel Protective Equipment	None

Table 7: A Comparison of Working Conditions and Wage Structure of Male and Female Workers

	Male	Female
Wages	200-300/day	150/day
Working hours	8-10 hours	6-8 hours
Actual work done	All	Plastic waste sorting

Chief expenditure was reportedly in health, both by workers and business owners.

A few business owners reported to be functioning in loss for several years in running. Money-lending was informal, with most workers requesting loans from their employers. Business-owners took informal loans from other business-owners in the same area.

Job-hopping or attrition rate was found to be low despite appalling work conditions mainly because workers were not trained for any other process and suffered from poor literacy and awareness levels.

Women were observed to be employed during plastic waste sorting. Child labourers were not observed in waste recycling units.

Average income of workers in all the waste recycling units ranged between INR 1000-4000/month. It was reportedly INR 10,000-25,000 for the plastic recycling unit owners.

ii. Health Hazards

- Aluminium foundries created immense air pollution. Workers in the Aluminium foundries were observed to function under hazardous conditions with toxic substances without protective clothing, which affected their life expectancy. Their life expectancy was reportedly 50-55 years only and the migrant labourers were forced to leave the job and return to their native places within 4-5 years.
- Plastic containers for sorting and washing may contain hazardous chemicals, which can come in contact of the workers handling it.
- Noise pollution was observed to be a significant issue during crushing of plastic waste.
- Cardboard recycling workers reported bed bugs as a problem.
- Apart from individual industry-related hazards, health hazards were also reported because of over-all poor and unhealthy living conditions. Due to very few toilets (only two in the industrial section), workers were forced into open defecation, leading to gastro-intestinal infections.
- Considering the sun-less conditions of Dharavi workplaces and proximity with Mahim Bay and several open *nalas*, mosquitoes were reported to be a major problem.

c. Environmental Impacts

The environmental impact of waste recycling is enormous. In the absence of such recycling, the waste will find its way to landfills, choke our drains and malign our roads and railway tracks. It will also create health hazards for man and cattle alike. This makes recycling industries an essential part of urban planning. However, the environmental impacts of these recycling industries are also necessary to be outlined. Plastic recycling industries, in general, involve only the sorting, washing, crushing, dyeing and pelleting of plastic. Plastic waste may be contaminated with hazardous chemicals, oil and grease and other materials, which will be touched by the workers during handling and dissolve or mingle with water used for washing. Its crushing in a machine creates noise pollution. The spent dyes involved in colouring the plastic are not disposed properly in the absence of an effluent treatment plant.

d. Challenges of Small-scale Industries at Dharavi

Most of the industrial units in Dharavi were unregistered, due to which they were saved from paying income tax. However, this also had a negative side – they forfeited the right of garnering the benefits of government funding schemes. Financial insecurity and no formal money-lending source was thus, a severe challenge. In fact, one business owner complained that he had to continue running a debt-ridden plastic recycling unit, as he would get no more credit if he shut down the unit.

Another major challenge reported by small-scale industries in Dharavi was the staggering cost of electricity. Priced at INR 16/unit, exorbitant electricity bills were forcing several business owners to shift out of Dharavi into other localities such as Vasai and Nalasopara.

While water was free-of-cost for most of the units, some owners did report a water meter and a water bill of INR 350-400 per month.

Considering that the business owners were actually illegal dwellers, they constantly existed in the fear of being forced out by the government.

No health security measure was provided to the workers who worked without sunlight and fresh air, without clean water and decent toilets and without personnel protective equipment such as helmets, gloves, boots and masks.

Neither workers nor owners had any formal social security.

Workers – both men and especially women workers were underpaid.

Workers as well as business owners being untrained for any trade other than the one they were engaged in, suffered from the lack of other job opportunities and forced to remain in the underpaid, debt-ridden and hazardous jobs at Dharavi. Low literacy and awareness levels coupled with desperate poverty back home seemingly chained the workers to their underpaying and health-threatening jobs.

5. Conclusion and Future Scope of Work

Dharavi's recycling zone could be the way forward to a sustainable future. Dharavi is a teeming centre of small-scale industries, but the challenges faced by the entrepreneurs and workers here are massive. It is imperative that the Indian Government intervenes, attempts to get all the units registered, provides financial and health security to the workers and improves the living and working conditions. The future scope of work in this locale is enormous from the socio-economic point of view. More detailed surveys must be carried out to glean all possible information regarding the various businesses thriving in Dharavi. Also, the business model of the waste recycling and other industries housed at Dharavi needs to be scrutinized in detail and compared with other existing models in India and abroad so that their productivity is retained while living and working conditions are improved.

6. Recommendations

General

- The role of the Indian government is undeniably required to be stronger and more visible. However, any set of regulations aiming at integrated waste recycling *must* include and, in fact, aim at bettering the lifestyle and security of the workforce earning its scant livelihood from this informal sector. This workforce needs to be recognized, registered and remodelled into a well-organized structure.
- Waste recycling requires technology input – this must be provided to the workforce involved in this activity

- A sincere, disciplined and positive attempt must be made in the direction of on-source waste segregation and reduced littering.
- Provision of personnel-protective equipment (PPEs) for waste recycling workers is a must
- Bigger and better markets must be explored for the recycled products to ensure that sick and debt-ridden units can make good
- Increased financial security needs to be provided to the workers and entrepreneurs in terms of formal loans

For Dharavi

A re-development of Dharavi is on the cards. However, one can only hope that such a re-development takes into account the unique history and spirit of Dharavi. A typical housing society with high rises, concretized gardens, malls and multiplexes appears hardly suitable. It is more important to retain all the activities taking place at Dharavi while making them more airy, sunlit, and spacious and provided with toilets.

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