

## Sustainable Student Entrepreneurship Scheme in Plastic Waste Management for K-12 Educational Institutions

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**[Abstract]** Plastic products have become an integral part of our daily life as a basic need. It produced on a massive scale worldwide and its production crosses the 150 million Tons per year globally. The quantum of waste is considerably increasing day by day due to increase in population and developmental activities and indiscriminate littering and disposal. In this paper, we explore the scope of K-12 school student Inclusion to address the issues of Waste Management. The students will be bringing recyclable plastic waste to their schools on a daily /weekly basis. A Management Information System developed and stored in the Cloud will be used by the schools.

The School authorities make the input of the details of waste collected by each student and equivalent value-based points will be allotted to them. These points thus generated become savings for the students. Students can convert these points for the purchase of educational products such as Skill Development tools, Information and Communication and Technology applications, Project kits etc. It can also be used for some entrepreneurial initiatives to be undertaken in the school. Students also become familiar with e-commerce activities. Hence the scheme develops entrepreneurial skills in the school students while providing environmental education. In this paper, the Sustainable waste Management Model developed addresses the burning issue of plastic waste management prevailing in the society.

**[Keywords]** sustainable waste management, plastic waste, entrepreneurship, management information system, environmental education, information communication and technology (ICT)

### Introduction

In India, more than 15,000 Tons of plastic waste is generated every day, of which 6,000 tons remain uncollected and littered. Significant environmental challenges associated with the waste generation with rapid urbanization. Over 377 million urban people live in 7,935 towns and cities and generate 62 million tons of municipal solid waste per annum. Only 43 million tons (MT) of the waste is collected, 11.9 MT is treated, and 31 MT is dumped in landfill sites. Solid Waste Management (SWM) is one of the essential services provided by municipal authorities in the country to keep urban centers clean. Collection of waste, transportation, primary and secondary treatments and disposal have become highly critical and complex. Current systems exist today cannot completely handle the quantity of waste generated. Plastics waste is a significant portion of the total municipal solid waste (MSW). More than 15,000 tons of plastic waste is generated in India every day, of which 6,000 tons remain uncollected and littered. More than three-fourths of solid waste management budget is allotted to collection and transportation. Though government plans

exist, The Energy and Resources Institute (TERI) showed that almost half of people in the 35–44 age bracket were unwilling to segregate their waste at all. Looking at the whole aspects of new dimensions, there is a need for a sustainable system to address all these issues. The system redraws long-term vision in plastic waste management by considering K-12 student community to become self-motivated and contribute towards socio-economic sustainable development.

### *Description of Plastic Waste*

In India, approximately 8 Million Tons of plastic products are consumed every year. Its broad range of application in films, wrapping materials, shopping and garbage bags, fluid containers, clothing, toys, household and industrial products, and building materials. It is a fact that plastics will never degrade and remains on the landscape for several years. Mostly, plastics are recyclable but recycled products are more hazardous to the environment than the virgin products. The recycling of virgin plastic material can be done 2-3 times only because after every recycling, the plastic material is deteriorated due to thermal pressure. Considering, 70% of plastic consumption is converted as waste, approximately 5.6 million tons per annum (TPA) plastic waste is generated in the country, which equals to 15342 tons per day (TPD)

Plastic waste has a significant portion of total municipal solid waste (MSW). Hence, there is a formal system of waste collection in urban areas. However, informal sectors i.e. rag pickers, collect only value-added plastics waste such as pet bottles etc. Plastic carry bags and low-quality plastic less than 20 microns do not figure in their priorities. This is so because collecting them is not profitable. This is primarily because the rewards are not much than efforts required for the collection, and this leads to plastic bags and other packaging materials continuing to pose a major threat to the environment. Moreover, the major concern for this waste stream is that these are non-biodegradable and remains in the environment for several years. Clogging of drains by plastic waste is a common problem. The packaging and polyvinyl chloride (PVC) pipe industry are growing at 16-18% per year. The demand for plastics goods is increasing from household use to industrial applications. It is growing at an annual rate of 22% annually. The polymers production reached 8.5 million tons in 2007.

### *Categories of Plastic Waste*

The term “Plastic” is referred to a wide range of synthetic or semi-synthetic polymerization products. The plastics waste constitutes two major categories of plastics; (i) Thermoplastics and (ii) Thermoset plastics. Thermoplastics constitutes 80% and thermoset constitutes approximately 20% of total post-consumer plastics waste generated in India. As per BIS Classification, there are seven categories of plastics like; PET, HDPE, PVC, LDPE, PP, PS and other. The typical thermoplastic and thermosetting resins have shown in Table 1.

*Table 1*

*BIS Classification of Plastics*

S. No.	Thermo plastic	S. No.	Thermoset Plastic
1	Polyethylene Tetrathalate (PET)	1	Bakelite
2	Polypropylene (PP)	2	Epoxy
3	Poly Vinyl Acetate (PVA)	3	Melamine
4	Poly Vinyl Chloride (PVC)	4	Polyester
5	Polystyrene	5	Polyurethane

Among all these plastics, the majority of the wastes come in the class of PE and PET which is having sufficient weight and thickness compared to other categories. The following table shows different commercial plastic materials mainly used in the household segment.

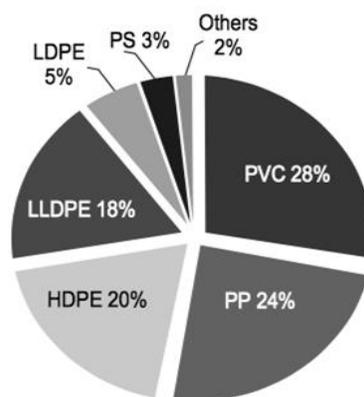
Table 2

*Physical Properties of Waste Plastics*

Commercial Plastic material	Nature of Plastic	Thickness
Cup	PE	150
Carry bag	PE	10
Water bottle	PET	210
Cool drinks bottle	PET	210
Chocolate covers	Poly ester + PE + metalized polyester	20
Parcel cover	PE	50
Supari cover	Polyester + PE	60
Milk pouch	LDPE	60
Biscuit covers	Polyester + PE	40
Decoration papers	BOPP	100
Film	PE	50
Foam	PE	NA
Foam	PS	NA

*Recycling of Plastics*

The plastics industry is one of the fastest growing industries in India. It has expanded at ~8% CAGR over the last five years. The figure shows the demand for plastic types. More than 98% is recyclable.



Source: Chemicals & Petrochemical Statistics, Analysis by Tata Strategic

Figure 1. Demand breakup of plastics by types

Currently, in India, the number of organized recycling units for plastics is approximately 3,500 along with additional ~4,000 unorganized recycling units. Most of the plastics (PE, PP, PVC, PET, PS,) etc. could

be recycled via the mechanical route. Thermosetting plastics like PBT, SAN, and Nylon etc. are recycled by selected recyclers' plant in India. As plastic consumption is expected to grow at more than 10% CAGR for the next 5 years, the scope of recycling of plastics is vast.

### Objectives

The following objectives are laid for the present study

- Creating a novel way to collect, process and dispose of plastic waste through student social inclusions in collaboration with K-12 Education institutions
- Exploring the opportunity of information systems for value addition in the process waste management
- Developing student entrepreneurship culture in the K-12 education system
- To make the students involved in the process of environmental education
- To make awareness on e-commerce platform among K-12 students

### Entrepreneurship Education

Government Policy regarding Entrepreneurship Education is to encourage the students to opt for entrepreneurship as a career. The Government is planning to introduce entrepreneurship in the education system at all levels, that is, at the primary school level, Secondary and Vocational School Level and at in Higher Education and orient and prepare students for an entrepreneurship career by imparting skills, knowledge, and aptitude necessary for successful entrepreneurship journey. Besides these, the Government is imparting Entrepreneurship Education in society and Fostering Innovation-Driven Entrepreneurship through Incubation.

### *Waste Management Process*

This present scheme envisages the development of a culture of savings in the minds of students. As per the scheme, students can earn while they learn. At the end of the day, the plastic waste gets converted into equivalent values in terms of rewards points. These savings can be converted to either a lump sum points or into valuable educational products provided in the information system. By the end of each academic year, the students are able to generate a considerable income which can be utilized for entrepreneurial activities either individually, or in collaboration with the supportive institution who take care of student entrepreneurship can also be utilized for the purpose of organizing training and skill development programs. In exceptional cases, students can also convert points to cash also.

The following are the various phases of the process of Waste Management Scheme envisaged.

- I. Enrollment of Institution
- II. Agreement with waste disposal agency
- III. Data Input to Waste Management Information System (W-MIS)
- IV. Converting to value-based points
- V. Disposal of plastic waste
- VI. Recognition of Student and Institution in the process of Waste Management

### *Enrollment of Institution*

In this process, the K-12 Institution has to input institutional details such as Name of the Institution, and details of the students who are to take part in this initiative. the institution has to mutually agree to the terms and conditions mentioned in the process of plastic waste management. The school and waste disposal agents come to an agreement to make the process sustainable

### *Agreement with Waste Disposal Agency*

In this phase, the institution will come to an agreement with the waste disposal agency. The quantity of waste disposed at a time, the frequency of disposal and the details of value given in return for the waste will be mentioned in the agreement.

### *Data Input to W-MIS*

The students will be bringing recyclable plastic waste coming into the category mentioned in the MIS on a daily /weekly basis as decided by the students. A teacher/student representative will make the data entry of the plastic waste collected by each student. In the end, each student comes to know the points secured. The system also provides the cumulative information with respect to each student. The MIS Will generate equivalent value-based points.

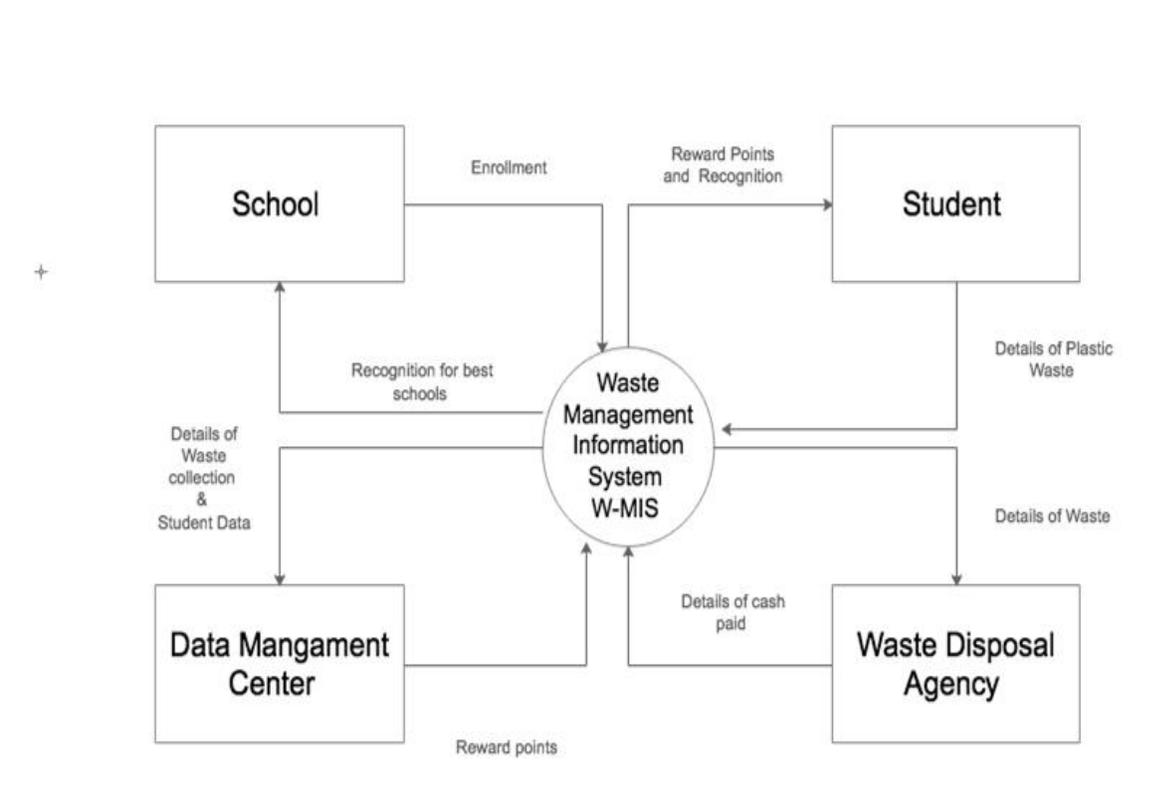


Figure 2. Data flow diagram of Waste Management Information System (W-MIS)

### *Green Club and Green Day Observation*

The schools registered will be forming a Green Club consisting of volunteers from students who are actively involved in the Plastic Waste Management Program under the supervision of some teachers. One day in a month will be observed as 'Green Day' dedicated to the collection of plastic waste by the students.

### *Rewarding Value Based Points*

The points generated by the students by submitting plastic waste can be converted into reward points. These points thus generated become savings for the students and can be converted can be used for the purchase of some goods such as Skill Development tools, Information and Communication and Technology applications, Project kits or it can also be used for some entrepreneurial initiatives to be undertaken in the school.

### *Disposal of Plastic Waste*

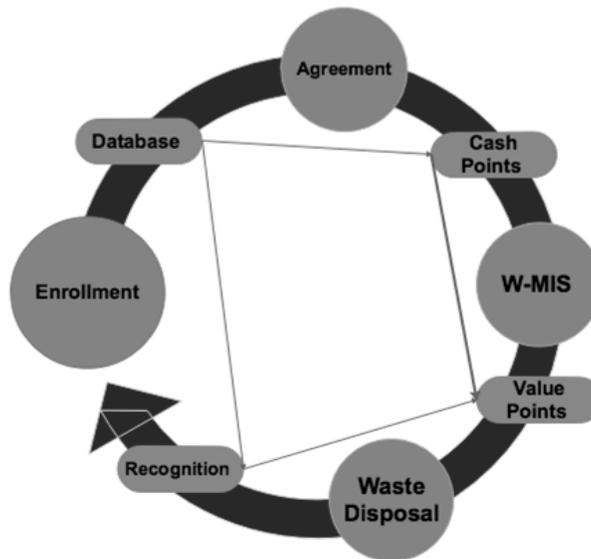
In the waste management process, an external waste disposal agency upon an agreement will be collecting the waste materials from the schools on a respective frequency. The amount provided by the agency will be submitted to the system so that cash flow rolls from the external agency to the system

### *Recognition of Students and Institution*

The institution which secures highest points will be provided due recognition for taking part in the process of environmental education, developing student entrepreneurship and value generation process. The students who secure maximum point will also be provided due recognition.

### **Sustainable Plastic Waste Management Model**

The following model explains the different process undertaken in Sustainable Plastic Waste Management. The basic processes in this model are Enrollment of Institution, Data Input to Waste Management Information System (W-MIS), Agreement with waste disposal agency and disposal of plastic waste. The primary stakeholders of the system are School, W-MIS center, Waste disposal agency, and Students. The input of the system is School enrollment details, Student enrollment details, details of waste, details of cash paid and details of value-based points. The rules and regulations for calculating value-based points will be considered for calculating value-based points. The system delivers three outputs such as Database, value points and student and institution recognition.



*Figure 3. Sustainable Plastic Waste Management Model*

### **Conclusion**

Plastic solid waste is ever increasing due to increase in population, development activities, changes in lifestyle, and socio-economic conditions. Plastic is the general term for a wide range of synthetic or semi-synthetic polymerization products. The rate of waste generation is growing very quickly owing to urbanization and higher incomes. Waste plastics can be collected from residential areas (domestic or household waste), streets, parks etc. The student community in this schools can play a vital role in the waste management process. The model discussed in this paper suggests the student community to become a role model in the process of waste eradication. ICT and Information systems can be a motivator in the waste

management process. They provide value-based points to the students for contribution. Students can convert these points for the purchase of educational products such as Skill Development tools, Information and Communication and Technology applications, Project kits etc. It can also be used for some entrepreneurial initiatives to be undertaken in the school. The Sustainable waste Management Model addresses the burning issue of plastic waste prevailing in the society.

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