B.Tech Project Report

on

Waste & Infrastructure Management Portal

(WIMP)

by

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<u>Abstract</u>

Our consumption habits and shifting socioeconomic conditions have made sustainable waste & infrastructure management procedures more difficult. Waste & Infrastructure Management is a multifaceted problem that necessitates the collaboration of technology, economics, sociocultural, and political activities. This project aims to summarize the most important factors influencing waste & infrastructure management practices, including the interaction of the aforementioned factors. In addition, the project gives some basic information on worldwide waste generation, infrastructure maintenance as well as an update on current sophisticated management technology. The interplay of the many components is highlighted. Eventually, various countries' waste & infrastructure management activities are compared in case studies.

Definition of the Problem

1. **Problem Statement :** To design a webportal where people can register complaints related to waste management or infrastructure maintenance in their locality. The webportal will also show the active issues and work status in the selected area. This webportal will also provide a platform where workers can find employment according to their skills. This platform will connect waste & infrastructure managers all over India.

2. **Identification of Problem :** Human activities generate waste, and how these wastes are handled, stored, collected, and disposed of can endanger the environment and public health. Solid Waste Management (SWM) problems and issues are of immediate importance in urban areas, particularly in the rapidly urbanizing cities of the developing world. Most governments recognise this, but rapid population growth overwhelms most municipal authorities' ability to provide even the most basic services. Typically, one-third to two-thirds of all solid waste produced is not collected. As a result, uncollected waste, which is frequently mixed with human and animal excreta, is dumped in the streets and drains indiscriminately, contributing to flooding, the breeding of insect and rodent vectors, and the spread of diseases. Furthermore, even collected waste is frequently dumped in uncontrolled dumpsites and/or burned, polluting water and air resources. A survey conducted by us led to unbelievable results which shows the current situation of waste management and infrastructure maintenance in various localities of India.

Data Collection (Surveys/ Discussion) : Since physical movements are restricted due to covid outbreak, we worked on vicarious experiences and we took surveys through Google forms, and discussed over Webex, Zoom, G-Meet etc. We attached some survey data below collected using Google forms.

Rate Waste Management System in your HomeTown
108 responses

60
52 (48.1%)
40
25 (23.1%)
20
14 (13%)
13 (12%)
4 (3.7%)
0
1   2   3   4   5
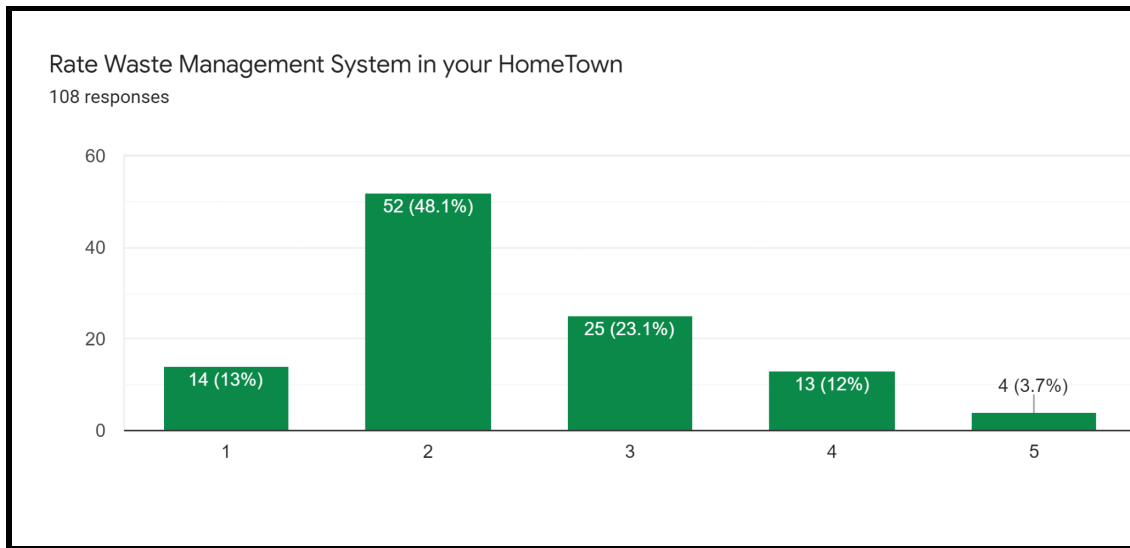
Fig 01 : Shows the public rating for waste management system in their society

Rate Infrastructure Mantainance System in your HomeTown (i.e Roads, Street Lights, Public Toilets, Public Parks, etc)
108 responses

60
53 (49.1%)
40
21 (19.4%)
23 (21.3%)
20
9 (8.3%)
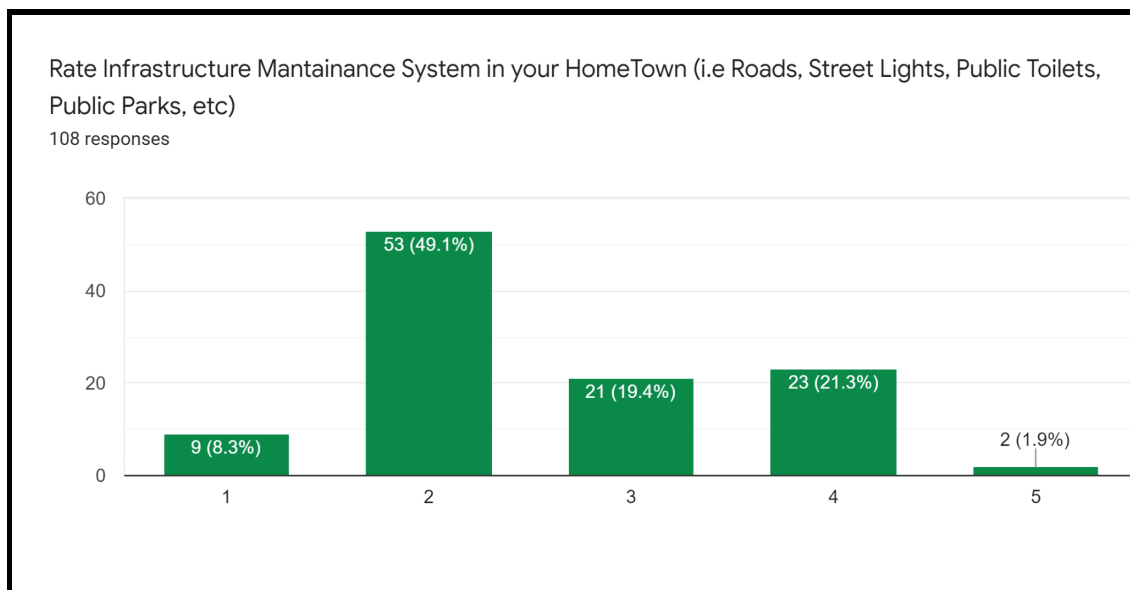2 (1.9%)
0
1   2   3   4   5

Fig 02 : Shows the public rating for infrastructure maintenance system in their society

3. **Current developments in the domain** : In today's world, we see dustbins placed along the roadside, and the dustbins are overflowing. This dustbin overflow is caused by increased population and waste from hotels, industries, and other businesses. This overflow of garbage will wreak havoc on our environment and cause a slew of diseases among the general public. There is not any special development in Infrastructure Management technology. In daily life, people encounter risky potholes on roads, dirty public toilets on roads as well as on railway stations. We planned to create a "Waste & Infrastructure Management System" to avoid this situation.

4. **Need and significance of resolving the problem** : If we are able to resolve this problem then following advantages can be achieved :
- Cleaner environment
- Better infrastructure, better India
- More work opportunity, less unemployment
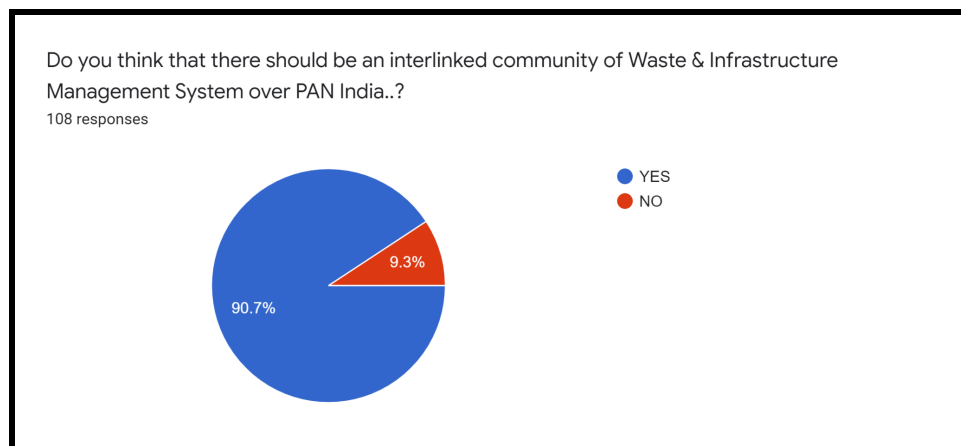- More stronger community & better co-ordination among municipality PAN over India

Fig 03 : Around 90.7 % people wants a strong community of Waste & Infrastructure Managers PAN over India

Introduction & Objectives

According to the 2011 Census, **India has a population of 1.21 billion people**, up over 181.5 million (mn) in the prior decade. India's population has been rapidly growing, increasing by 22% between 1991 and 2001 and 18% in the following decade. The Indian subcontinent's booming economy has resulted in a significant shift in the country's demography, from rural to urban culture, with a quick rate of urbanization, resulting in an estimated 600 million Indians moving to cities by 2031. Due to population increase, expanding economic activity, industrialisation, changing lifestyles, and the introduction of new technology, urbanization poses a multifaceted challenge to urban environment management (e.g. E-waste management & infrastructure management). As a result of the aforementioned issues, cities and towns have crumbled under mountains of garbage left in the open (to rot), as we have a tendency to fail to manage our waste due to a mismatch between demand and availability of services to alter an equivalent. We are currently not only limited to managing rubbish generated by our daily activities (typical municipal waste), but we are also required to manage waste generated by various industries located in the outskirts of our cities. Our trash is both dangerous and non-hazardous; some of it is biomedical, while the rest is from recent breakthroughs in the electronic and information technology industries. Poor waste management has direct consequences for the urban environment, resulting in air, water, and soil pollution, as well as long-term health consequences, and hence indirect consequences for our economy and growth prospects. As a result, a re-examination of the country's current waste management systems is urgently required. The parts that follow provide an overview of the many types of garbage and the need to enhance our systems in order to ensure the waste

management sector's long-term viability, with participation from both government and commercial entities. Every country's infrastructure is its backbone. Infrastructure development is proportionate to a country's economic growth. Roads, railways, ports, real estate, telecom, health, and solid waste management are all examples of infrastructure. Investing in infrastructure will help to boost the economy's growth rate (GDP). One percent of GDP growth necessitates a proportional one percent in infrastructure investment. Infrastructure development in India has a lot of potential. We currently have bad / broken roads with no adequate connectivity, a lack of power, a lack of potable water, unsanitary sanitation, and time-consuming trains that are not operating at full capacity. Inefficiencies, demotivation, and low productivity result, delaying urbanization's progress. Government investing in infrastructure will not only build infrastructure, but will also provide jobs for thousands of people, as well as chances for people to think and participate. Infrastructure investment creates jobs in a variety of ways, including direct, indirect, and derived employment. People who work directly on the core, such as construction workers in the case of real estate. People who offer the raw materials and others who assist with the construction activity will benefit indirectly. People who profit directly or indirectly spend money on a variety of goods. When consumers spend money on products, the vendor of those goods benefits in some way. Our objective is to make our India clean with well maintained infrastructure using modern tools and innovations.

Tools & Techniques

We want to introduce a web portal where people can select their locality and register complaints related to waste management or infrastructure maintenance. Working people can also seek temporary or permanent works on the platform the PAN India community of waste and infrastructure manager will manage and ensure a smooth on going work process, this portal also shows the current work status and expected time required to complete ongoing work. We can use technologies like HTML, JavaScript or CSS for developing the frontend of webportal, for backend we can use any technology among node.js, express.js, MongoDB, Javascript or Python with Django. For hosting the website we should choose among hostinger or AWS.

Detailed Work Plan/Technological Interventions

Every year, the world produces 2.01 billion tonnes of municipal solid garbage, with at least 33% of that not being managed in an environmentally sound manner. India generates **62 million tonnes of waste each year**. About 43 million tonnes (70%) are collected of which about 12 million tonnes are treated and 31 million tonnes are dumped in landfill sites. Open dumping has a lot of disadvantages like infectious diseases, land and water pollution, obstruction of drains and loss of biodiversity.

So, in this project, we will be creating an online platform where people can **register complaints** related to waste management or infrastructure maintenance in their locality. The web portal will also show **the active issues and work status** in the selected area. This web portal will also provide a platform where workers can find **employment** according to their skills. This platform will connect waste & infrastructure managers all over India.

This platform will help to create **collaborative partnerships** among different stakeholders of the Waste Management Sector. This will promote a Circular **economy** for different waste streams by creating a sustainable value chain. The association encourages technological advancements, research, and collaborations for industry progress. This will make an **economic, environmental and social impact**.

Below Figures depict various kinds of waste streams :

Municipal Solid Waste

Construction & Demolition Waste

Bio Medical waste

Plastic Waste

Toxic and Industrial Hazardous waste

E-Waste

Stakeholders Engagement :

Local government

Nongovernmental organizations

Multi-jurisdictional government bodies

Informal recycling workers

National or subnational governments

TYPICAL WASTE SECTOR STAKEHOLDERS

Residential waste generators

Private companies

Commercial and industrial waste generators

Academic institutions

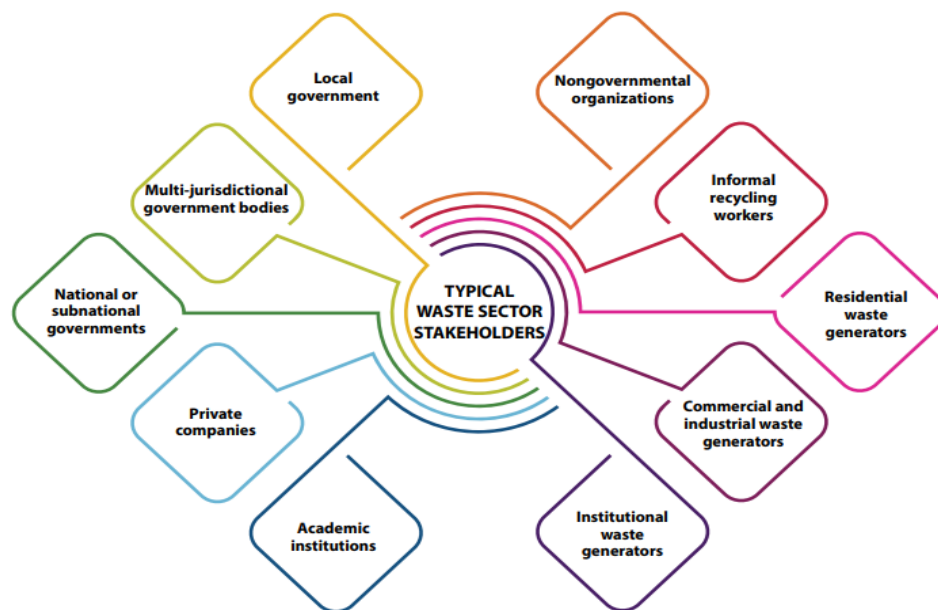Institutional waste generators

Fig 04 : Shows network among stakeholders engagements

Novelty / Innovations of Proposed Interventions

We are basically making a bridge between the waste generator and local bodies who collect wastes and make gold out of waste. As upto today's we don't have a proper system of what is the amount of waste generated in a day and how can we use this waste to make a gold out of this with proper management. We have also made a complaint application portal which helps individuals making complaints related to waste in the society and households. Through this portal we are contacting local bodies who are doing waste management jobs and able to tackle that problem. This application benefited both the government and local people as it shows real time track of problems. The local person who is engaged in this job also gets benefitted as all things come online and they can also complain easily and the work conditions will be also improved through this website. As this website united all the municipalities of India which really gives strength to all waste warriors.Through this data we can see that this is the need of hour now.
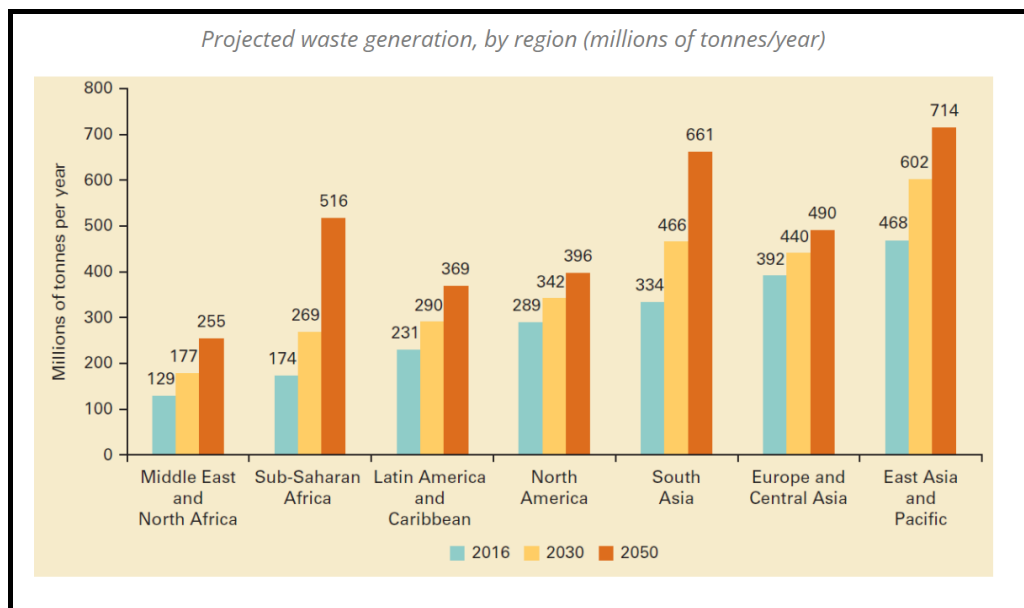

Fig.05 : Waste Generation (million of tonnes/year)

Approaches that could be taken to implement intervention plans

We will first see what we can do to solve this major problem in India. Firstly I want to discuss how different countries are tackling these problems and what we can do in India.

SWEDEN: FROM WASTE TO ENERGY

The Scandinavian country is one of the European regions with the most environmentally conscious cultures, and so has one of the highest recycling rates. The effectiveness of Sweden's waste management system is due to residents' increased understanding of the importance of the first step: separation. Swedes sort their trash into different coloured bags based on the kind of garbage, while recycling factories sort it into recyclable and non-recyclable components. Waste that cannot be recycled is burnt in plants that convert its combustion into energy (a process known as "waste to energy") to power the country's 250,000 residences. Recyclable materials go through the usual conversion process to become new materials. The method has been so effective that the amount of garbage produced by Swedes is insufficient to feed all of the plants. To maintain them fully working and create electricity in a more sustainable method than burning fossil fuels, the government must import garbage from neighboring countries such as Germany or the United Kingdom.

JAPAN: THE PATH TO ZERO WASTE

Japan is one of the most environmentally conscious countries in the world. Aside from the environmental commitment, the technological necessity to handle the massive amounts of garbage created by millions of people in its vast cities is critical. Furthermore, the Japanese have demonstrated that they are

exceptionally adept at reusing and recycling their garbage. The government of the country supports and encourages water separation, and residents meticulously manage their own garbage through a system of categorization and pick-up schedules that they flawlessly follow.

THE NETHERLANDS : REUTILIZATION AND SUSTAINABILITY

Another example of sustainability is the Netherlands, which successfully applies sustainability ideas to mobility, building, and consumption. The creation of two sections of a bike path constructed completely of recycled plastic in the towns of Zwolle and Giethoorn in 2018 is a clear example of recycling materials in this nation. Plastic has been used to construct highways in other parts of the world, but this was the first time they were fully built of plastic.

The Netherlands has a strong commitment to renewable energy and investment in creating programmes that will bring the country to a circular, sustainable economy, in addition to a clear commitment to reuse of all sorts of materials.

WALES : A SUCCESS STORY

In under 20 years, the country has increased its recycling rate from 5% to 64% of household garbage. These results are the consequence of the government's ambitious set of policies aimed at encouraging citizens to embrace the circular economy. By 2050, there should be no garbage in landfills or incinerators.

The elimination of single-use items, the obligation to segregate domestic garbage, and the engagement of industrial producers through a responsibility system are only a few of the initiatives. The nation has also recommended the

construction of recycling factories capable of processing non-recyclable materials such as mattresses and diapers.

Semakau Landfill: Not Just A 'Rubbish Island'

Because that's what it generally is, the name "landfill" conjures up images of a stinky mass of garbage. Prepare to be awestruck by a dump that is a biodiversity hotspot with blooming mangroves, rich coral reefs, and a thriving bird and marine life capital. The Semakau Landfill was Singapore's first offshore landfill, and it is currently the city-only state's remaining landfill.

As in many countries we have seen that recycling is a major component in all the countries and the waste which is not recycled is used for the energy generation. So, after collecting the problem in the society we transform the information to government organization "Nagar Nigam" comes under the treatment . We are basically making a website which can easily record the problems and help the government in the proper way to act toward waste management. Through this website any waste management enthusiasts can also invest in this waste management and Infrastructure industries. In this we are creating a society who is really very enthusiastic to solve the problem of waste management as this is the need of the hour.

<u>Possible constraints & barriers to implementations, design issues</u>

As already discussed above, we are developing an online platform to create **collaborative partnerships** among different stakeholders of the Waste Management Sector. Here people can **register complaints** regarding waste management and infrastructure in their locality. Moreover, independent workers can also find **employment** through this platform. But, there are a few constraints and challenges involved in this field of waste management. Let's discuss these:

- **Limited Technical Expertise:** As the target audience for this project also involves independent workers working in the field of waste collection and transportation, it is quite possible that they will not be able to make full use of this platform to get employment due to lack of technical knowledge.

- **Limited financial resources:** Many cities have insufficient resources for long-term infrastructure or operations investment. Cities are frequently responsible for implementation but lack the necessary funds or financial competence, and they struggle with investment costs, facility upkeep, developing a sufficient budget for solid waste projects, or rising costs and insufficient income as the volume of waste grows.

- **Political Turnover:** New officials and key staff reassignments on large capital projects, such as solid waste management projects, can result in projects being shut down or substantially altered by incoming officials and key staff reassignments.

- **Lack of planning and evaluation** at both national and municipal levels can negatively affect the success of a solid waste management system. National frameworks or rules are necessary to support long-term planning, establish national standards, and give incentives for waste reduction, recycling, and composting initiatives. Planning at the municipal level, where execution takes place, is frequently disregarded, which can lead to problems later.

- **Limited or lack of communications with relevant stakeholders**, including residents, can lead to illegal dumping, misuse and damage of containers, resistance to service fees, improper waste segregation, among other things. Coordinated communications and outreach programmes can assist in informing and equipping relevant stakeholder groups to comply with local solid waste management requirements.

- **Limited or lack of vertical and horizontal government coordination.** Solid waste management is usually the responsibility of several ministries or organizations at different levels of government. Government agencies responsible for the environment, urban and housing development, and agriculture, for example, may all be involved in different aspects of the solid waste management system but lack institutional collaboration frameworks. Furthermore, local governments are responsible for enforcing national legislation, and national governments can play an important role in fostering favorable conditions for successful local enterprises. A mechanism that allows coordination across agencies or departments, as well as between government layers, can aid in the creation of a holistic system.

Expertise available with each students to contribute in the development in the intervention

1) **Aayush Singh** : Can deploy frontend technologies like HTML, JavaScript or CSS for development of WIMP.

2) **Mayank Kumar** : Can deploy technologies like hostinger or AWS for hosting WIMP over the World Wide Web and He can also convey the voice of India to the government for a united community of municipalities.

3) **Neeraj** : Can deploy backend technologies like node.js, express.js, MongoDB, Javascript or Python with Django for development of WIMP.

WIMP : Waste & Infrastructure Management Portal

Expected Outcomes

Due to proper management of waste we get a green and pure environment. From this waste we convert this into energy in the form of electric energy. River pollution and Land pollution gets reduced due to proper management of waste. Due to our website, employment also increases and people of India also are able to learn a good habit of managing in the society. Through this quote, we conclude this -

"WE CANNOT HOPE TO CREATE A SUSTAINABLE CULTURE WITH ANY BUT SUSTAINABLE SOULS."

Suggested plan of actions for utilization of outcome expected from the work

Throughout the developing world it is the urban poor, often in the peri-urban areas, that suffer most from the life-threatening conditions deriving from deficient SWM. So, for the betterment of not only the environment but for the people also, we have come up with a unique idea of an online Waste and Infrastructure Management Portal (WIMP). This will not only help in generating employment opportunities but also will make an environmental, social and economic impact on the society and the country. This will promote a circular economy by creating a sustainable value chain.

Conclusions

- The five major problems in SWM in developing countries (inadequate coverage of the population to be served, operational inefficiencies of municipal SW services and management, limited use of the formal and informal private sector in recycling activities, problems with the management of (non-industrial) hazardous waste, and specific problems related to solid waste final disposal) still exist to a large extent and require increased attention.

- It is critical for municipalities to understand the actual costs of the various components of the SWM system, including waste disposal, in order to improve and correctly manage solid waste services. Authorities can make decisions, recognise opportunities, and prepare for the future when they have a clear picture of the costs of SWM services. The existing state of affairs is far from ideal.

- Community-based and private-sector participation can help expand solid waste service coverage and efficiency. However, there are some prerequisites for the successful operation of such models that must be considered.

- This online web platform idea will help to create collaborative partnerships among different stakeholders of the Waste Management Sector. This will promote a Circular economy for different waste streams by creating a sustainable value chain. The association encourages technological advancements, research, and collaborations for industry progress. This will make an **economic, environmental and social impact.**

Individual Contribution

1) **Aayush Singh** : Abstract, Definition of the Problem, Introduction & Objective, Tools & Techniques perceived to be effective for resolving the issue and Expertise available with each student to contribute in the development of the intervention.

2) **Mayank Kumar** :Novelty/Innovation of the proposed interventions, Approaches that could be taken to implement intervention plans, Data collection, Data analysis, Expected Outcomes, Conclusions and References.

3) **Neeraj** : Detailed Work Plan/technological interventions, Possible constraints and barriers to implementation, Design issues, Suggested plan of action for utilization of outcome expected from the work and Conclusions.

References

1. **Essential things needed for online platforms related to waste management :**

    https://meuresiduo.com/en/blog-en/online-platform-for-waste-collection-5-essential-features/

2. **For solid waste management :**

    https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/SWM/General_Overview/Zurbruegg_1998_Landfill.pdf

3. **MyWaste Management :**

    https://meuresiduo.com/en/blog-en/online-platform-for-waste-collection-5-essential-features/

4. **Trends :**

    https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html