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IDENTIFYING AND RANKING OF CRITERIA FOR THE SUSTAINABLE LOCATION OF WASTE TRANSFER STATION: A WAY OUT FOR WASTE TO ENERGY AND THREE R'S APPROACH.

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Abstract- Solid waste becomes a civic concern in this contemporary world. The public is more conscious about its possible hazards to the environment, health, and societal standard. To get rid of this, the countrywide concept is to reduce and recycle solid waste and build up large and distant landfills. In this circumstance, the waste transfer station is an attractive substitute to lessen solid waste by extracting recyclable and energy potential material and creates an incorporating nexus that lead to cost-effective deliveries from household to remote landfill facilities. Siting the waste transfer station in populated urban centers required the key functional role from a technical and financial perspective that assures environmental threats, people's health, and safety. Locating a waste transfer station is a complex assignment that comprises the evaluation of various factors: economic, social, and environmental. The purpose of this study is to identify and rank criteria for the sustainable location of the waste transfer station. For this, existing literature was studied and different factors were identified and ranked according to its frequency in literature. The study found that environmental concern is on priority following social and economic factors for locating waste transfer stations. Moreover, river, population density, and proximity to road constraint were ranked first in environmental, social, and economic factors respectively.

Keywords- Solid waste management. The waste transfer station, waste to energy, three R's Approach

1 Introduction

Household waste and waste from commercial and institutional locations, for instance, businesses, schools, and hospitals are known as Municipal solid waste (MSW) as stated by Environment Protection Agency (EPA)[1]. This waste must be amassed regularly and transported effectively. Moreover, it must be disposed of to assure healthy and sanitary life standards [2]. Municipal Solid waste generation is proportional to population growth. This is problematic for many developing countries. Solid waste management has been facing numerous challenges because of rapid urbanization, inadequacy in a financial and technical capacity, an ineffective policy that has made the herculean task for municipal management to deliver quality service to the citizen. The decision of location waste transfer station is long term planning that which has long term

impact on environment society and from economic perspective. [3]Solid waste is a social catastrophe that requires a definition of credible government policies, suitable location of the waste transfer station, landfill site, and required technical support. Clear City, has an outcome of effective solid waste management services. The unpolluted city is a successful city for residents to become healthful. It improves social morality, moreover, it also attracts tourists. It has thus been suggested that the cleanliness of a city can be used as a proxy indicator for the social values of its residents, which is a major objective of social development programmers [1].

The criteria on which decision would be taken for the location of waste transfer station has played a vital role in waste management[4] Solid waste also damages the environmental condition in society. According to the Global Waste Management Outlook report, 2015 issued by the UNEP agency stated that an improved version of solid waste management would minimize 15 to 20 percent of greenhouse gas emissions. Therefore by locating a suitable site, solid waste would be handled effectively [1].

further, a study showed that forty percent of solid waste is not collected from the street which is disposed of in open-air [5]. That has become the major reason for many problems including health problems, environmental pollution, an untidy city, damaging sewerage, and mass transit network in the city. Furthermore, a study showed that these open disposed of solid waste in the street is an inhabitant place for bacteria that spread viral and bacterial diseases. That results in a decline in health standards and an increase in medical expenditure.

Multi-criteria identifying and ranking are techniques commonly that require decision-makers to assign weightings of importance to the decision criteria based on the criteria are ranked.[4] This study has focused to identify and rank the criteria for the sustainable location of waste transfer stations from existing literature. This will help the policymaker, engineers, and government to consider the criteria and their importance while deciding for locating waste transfer stations, especially in urban centers.

2 Role of Waste Transfer Station in Solid Waste Management

The waste generated by households must be amused regularly and transport effectively. A waste transfer station in solid waste management provides a consolidating nexus between the collection program of municipal solid waste management and landfill site. In the waste transfer station, solid waste is collected to the waste transfer station where a recyclable material and material with energy value would be extracted from the whole waste. The remains are transported to the landfill site. Waste transfer stations save collection time and costs associated with transportation. Moreover, by extracting recyclable and energy value material a substantial amount of solid waste is reduced for the landfill site.

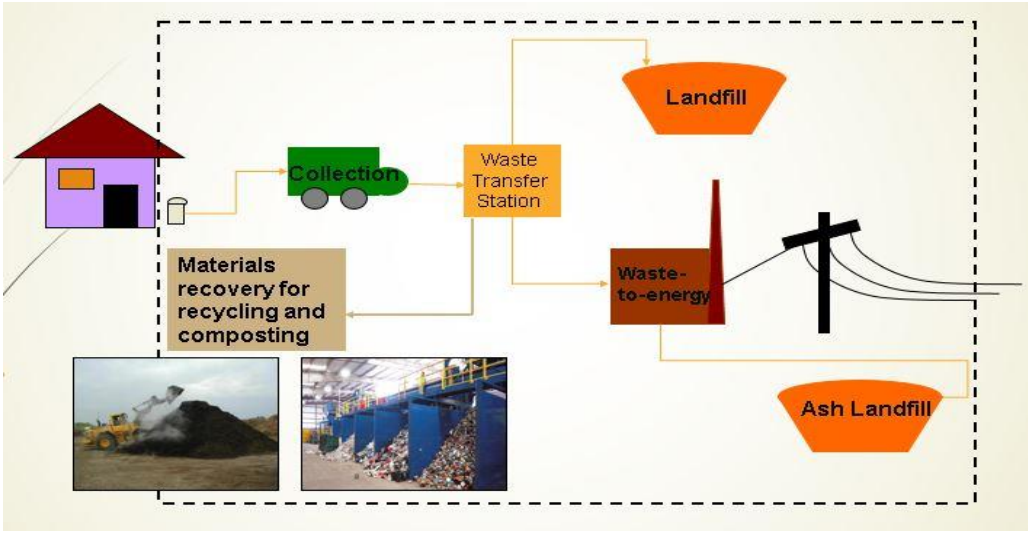

Figure 1: ***Role of a waste transfer station in solid waste management***

3 Sustainable Location of Waste Transfer Station

Locating a waste transfer station is a complex assignment that comprises the evaluation of various factors: economic, social, and environmental. By examining the criteria of deferent factor, a sustainable location of waste transfer station would be located. For any sustainable city, the sustainable mechanism for getting rid of waste has paramount importance this Waste Transfer Station provides a sustainable solution for our growing urbanization. Hence its sustainable location must weigh the importance of social, economic, and environmental constraints.

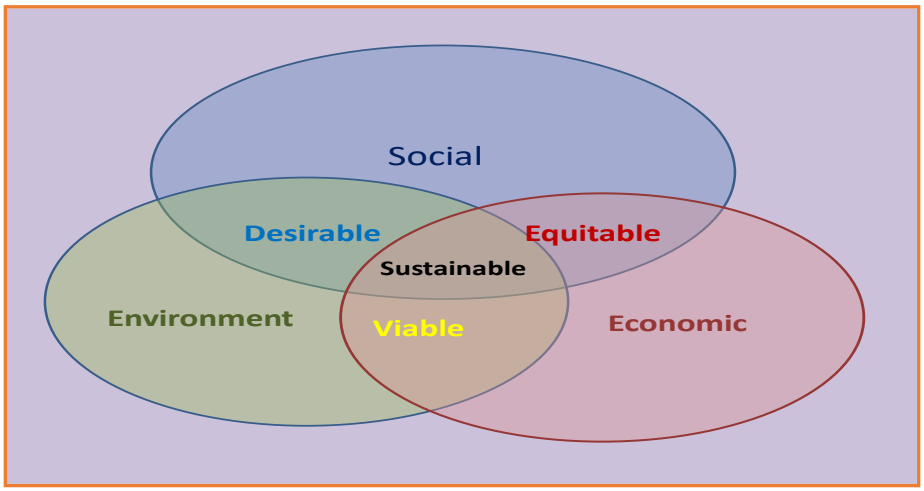

Figure 2: ***locating sustainable waste transfer station***

4 Results and Discussion

Determination and ranking of relevant criteria for a potential location for a waste transfer station in an urban Centre required consideration of different factors: economic, social, and environmental. In the literature review, different authors (s) have considered different criteria. Here according to weightage different criteria were ranked. Weightage would be given to those criteria in which deferent authors have worked.

4.1 Environmental Criteria.

In the literature review author(s) have work on different criteria for an environmental factor, according to the frequency of their work here in chart 1 these criteria were weightage and ranked. As result shows that rivers have the highest weightage and are ranked as one and follows slope, geology soil, and drainage respectively.

Table 1- Criteria for environment factor

Environmental Factor	Author(s)	Weightage	Rank
Rivers	[6] [7][8][9] [10] [11][12][13]	8	1
Geology	[6][7] [10][14][15]	4	3
Drainage	[9] [14]	2	5
Slop	[6] [9][10][14][11] [16][13]	7	2
Soil	[10] [14][11][15]	3	4
Vegetation criteria	[7] [10]	2	5

4.2 Social Criteria

The location of the waste transfer station matters most from a social perspective as it is directly linked to people's health and living conditions. Moreover, if the waste is a nearby populous or major place, as Mosque, shopping mall, schools, and hospital, it creates a problem for the public and increases the chance of health issues especially viral disease. Here in social factors, four criteria were kept in consideration. The population density secures the highest rank in social factor whereas land cover, major place: Mosque, shopping mall, schools and hospital, and distance from railway secure second third and fourth rank respectively.

Table 2.Criteria for Social factor

Social Factor	Author(s)	Weightage	Rank
Population density (Person per hector)	[6] [8] [9] [10] [14][11] [16][13]	8	1
land use/cover	[6][10][8] [14] [11][16][15]	6	2
Major place	[7] [9] [12]	3	3
Distance From Railway	[10]	1	4

4.3 Economic Criteria

Economic consideration in the location of the waste transfer station has priority because in solid waste management most of the cost is associated with transportation activity. By locating an optimal location transportation activity would be minimized. Keep in view this scenario, the criteria were set to minimize the total transportation cost. Moreover, land value is also considered as in urban center land value is more than their outskirt. In the literature review location of the waste transfer station with respect to road and landfill site is considered. However in deferent research paper proximity to road secure highest rank fallowing land value and proximity to a landfill site.

Table 3. Criteria for Economic factor

Economic Factors	Author(s)	Weightage	Rank
Proximity to Roads	[6] [8] [9] [10] [14][11] [16][13]	8	1
Land Value	[6][10][8] [14] [11][16][15]	6	2
Proximity to Landfill	[10]	1	4

5 Scope of research

The sustainable location of waste transfer stations especially in the urban center is a challenging task. Because there are multiple factors are linked with this. Which include environmental. The economic and social factors. However, this study will help engineers, policymakers, and the government to consider these factors while taking decisions regarding the location of a waste transfer station. These factors have been identified from existing literature and ranked according to their frequency in the existing literature.

6 Conclusion

Identifying the criteria for optimal location of waste transfer stations has improved the efficacy of solid waste management. In this study, criteria were categorized into three factors that are environmental, social, and economic. First, Rivers, the

slope of surface and geology of surface has tope three criteria in environmental factor respectively. Second, Population density, land cover, and land use have ranked as the top three criteria in social factors respectively. Third, in economic consideration proximity to the road, land value and proximity to landfills are prioritize in different study respectively. For the optimal location, these three factors must be assured for the best location which is eco-friendly cost-effective, and wouldn't disturb the social ethos of society.

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