



Sustainable Development through the Management of Household Bio-Degradable Waste

Aneesha K Shaji, Assistant Professor, Department of Commerce, Kristu Jayanti College (Autonomous), Bengaluru, Karnataka, India, aneesha@kristujayanti.com

Surjit Singha, Assistant Professor, Department of Commerce, Kristu Jayanti College (Autonomous), Bengaluru, Karnataka, India, surjitsingha@kristujayanti.com

Ajith P Mathews, Assistant Professor, Department of Commerce, Kristu Jayanti College (Autonomous), Bengaluru, Karnataka, India, ajithmathews@kristujayanti.com

Abstract: The environment is an essential factor for sustainable development processes. Environment conservation is always a concern for every part of the world. Sustainable development can be made possible only through the proper utilization of natural resources and keeping the environment clean from various pollutions. Management and disposal of waste, both degradable and biodegradable, are inevitable for environmental conservation. Protection of the environment in an efficient manner leads to the economic and social well-being of all the nations. Waste management in India relies on actual waste generation, storage, collection, transportation, refining and disposal and various other factors. Most of the Indian cities rely on municipal corporations for waste treatment and public health services. Even though this is the current situation, waste disposal and management are a crucial challenge to society. This prevents our country from achieving sustainable development goals. In this scenario, a permanent and practical solution for biodegradable waste management is inevitable, especially in metropolitan cities. The present study carried out among 59 respondents residing in Bengaluru, Kothanur area. This study's primary purpose is to examine how sustainable development can be possible by effectively managing household bio-degradable waste. Ultimate results of this study help in the environment development and proper environment conservation.

Keywords: Sustainable Development, Environment, Household Bio-degradable waste, Waste disposal

I. INTRODUCTION

Natural resources are used for our day-to-day usages; depletion of it will cause severe environmental damage. For human survival, we need raw materials and various resources from the environment. The ecosystem acts as a cleaner that collects and recycles waste materials at minimal to no cost to society. This role is getting greater attention now, particularly with the way we treat sewage.

Bengaluru is considered as one of the fast-moving metropolitan cities of India; most of the fortune 500 companies are in Bengaluru; with the increase in the Industries, Companies, Educational institutions and Job opportunities, there is a rapid increase in the human population, and it became a cultural hub of India where diversified people from across the world lives together. With the rise in population, the generation of the household's biodegradable waste also had tremendously increased. A family of four generally generates 4 Kg of biodegradable waste in a single day. The disposal of biodegradable waste becomes troublesome if we cannot dispose of it within a day or two. There are assigned municipal bodies who are supposed to collect the waste daily, but the ground reality is different, they collect the waste every alternate day, and the public have to pay an additional amount each month; otherwise, they decline to collect it.

Further, they come only at a fixed time; those who work on different shifts may find it difficult to dispose of it. Around 5000 tons of waste is generated in Bengaluru city each day, out of which only 30% waste is collected by BBMP directly, and the remaining 70% of municipal solid waste is collected and transported through contractors as per the study conducted by Naveen, B. P., & Sivapullaiah, P. V. (2016). Due to lack of proper management of the Bio-Degradable waste, it is dumped in open spaces or any vacant area, which leads to the spread of epidemics like cholera, diarrhoea, waterborne disease, Typhoid, Dengue, and various other diseases. Further, it also contaminates the groundwater, blockage of drainage, and unhygienic lifestyles of the people.

So, it is very evident that the disposal of waste is becoming a challenge in everyone's life, specifically those who live in cities like Bengaluru. This can adversely affect our sustainable development. The present study aims to find out the current problems faced by the households residing in the Kothanur area and suggest innovative remedies to minimize and manage the biodegradable waste in a sustainable manner.

II. STATEMENT OF THE PROBLEM

Disposal of waste of any kind is a challenge in everyone's life, specifically those who live in cities; Non-biodegradable waste has a limited challenge as the households can store it and dispose of it whenever they want, further there is also a scrap value for it. Still, the problem arises when it comes to Bio-Degradable waste as it cannot be stored for more than a day or two. This can be a threat to our environment. Sustainability in the environment cannot be achieved because of these issues. So it is necessary to understand the various problems and challenges faced by the households living in the Kothanur (Bengaluru); also, different methods and ways of managing and sustainably disposing of biodegradable waste should also be identified.

III. LITERATURE REVIEW

Munasinghe (1993). Ecological resilience depends on how robust environmental and physical processes are. Protecting habitats is a vital aspect. "Natural" structures cover all facets of the biosphere and human-made ecosystems, including cities. The emphasis is on the system's capacity to respond to changes rather than the existence of any perfect state.

Redclift (2005). Sustainability is a good planning practice rather than a weak one because it is impossible to replace resources over nature. As conservation biologists, if we aim to conserve the ecological character of the carrying capacity of an environment, sustainable planning must include the management of natural resources in the interest of the environment's biological carrying capacity. Sustainability is no longer solely a question of preserving and improving current functional resources; it is a matter of engineering new applicable resources.

Ianos (2009). The environmental protection policies have to be enforced in a very dynamic sense, as we experience, on the one hand, the globalization of local environmental factors and, on the other hand, the globalization of broader environmental factors. Respect for the environment can harmonize the two processes: it promotes the diversity of the local environment and their diffusion through the globalization process.

Opschoor (1999). Defences could be quantified, but only if environmental depreciation and the value of ecological loss were measured. Ethical problems around valuing or not valuing transhumanism and transhumanist ideas will still exist for decades to come. Since we have a desire to know the quality of the climate and help understand the impact of the environment, there will always be a need for environmental measures.

Snel, M. (1999). Stated that the municipality is primarily responsible for waste disposal and that participation of the citizens is inevitable in the waste disposal. The researcher also noted that vermiculture needs to be integrated to recycle biodegradable waste. Community participation is a must for the management of biodegradable waste.

Ogbonna, D. N., Ekweozor, I. E., & Igwe, F. U. (2002). Their studies stated that many of the issues related to the management of household waste management are due to the ruling government's policies' inefficiency. They further recommended that private waste management company or organization should be encouraged in this area. Awareness programmes in rural and urban areas will help generate awareness about environment conservation and eco-friendly waste management. Waste should be divided based on the nature of the items, such as wet waste, paper waste, metals, glass, plastic etc.

Ball, S., & Taleb, M. A. (2011). Examined that environmental awareness of travellers, governments and other agencies, the sustainability of resources, waste management, and hotels' restoration have made the waste industry a severe problem. The questionnaire was distributed to hotel managers responsible for monitoring waste management programs. Since 1994, hotels have successfully implemented waste management systems. However, the burden of waste generated by many hotels still exceeds international standards. One of the recommendations is to amend existing legislation to promote environmental management and waste management.

Dhere, A. M., Pawar, C. B., Pardeshi, P. B., & Patil, D. A. (2008). In their research, they stated that excess dumping of waste had created serious health issues among the people of Pune; an NGO named EXNORA has proposed remedies to manage the solid waste by the residents themselves, the idea was to promote a community-based decomposition of solid waste, another suggestion was to cover the waste with a layer of soil which will suppress the odour and will improve the environment.

Burcea, Ş. G. (2015). The formal sector and informal sector support the local community in their economic development. Public and private organization carry out activities by using modern technologies for economic activities.

IV. RESEARCH GAP

The various literature reviews related to the study do not prove useful in handling the waste management system, as many places in India are still facing effective waste management. So, environmental sustainability through proper waste management yet to address as a big issue. Very few studies focus on the effective waste management of Bengaluru city, especially in biodegradable waste. These gaps point out the relevance of the current research; hence the study has its value.

V. RESEARCH QUESTIONS

1. How effective is the present waste management system in Bengaluru to maintain a sustainable environment?
2. What are the ways and means to manage biodegradable household waste to make it sustainable in the environment?
3. What are the household's various issues when they want to dispose of their biodegradable waste, which can be a severe cause to the environment?

VI. OBJECTIVES

1. To analyze the effectiveness of the present waste management system in Bengaluru to maintain a sustainable environment.
2. To find out the ways and means to manage biodegradable household waste to make it sustainable in the environment.
3. To examine the household's various issues when they want to dispose of their biodegradable waste, which can be a severe cause to the environment.

VII. METHODOLOGY

7.1. Data Collection

A Structured questionnaire was prepared, and the survey method is used to collect the households' relevant data. Objective 1 and 2 is examined using a standard questionnaire (quantitative method). Objective 3 is examined using the interview method. The questionnaire is adopted from Kannan, R. (2017) and the questionnaire is modified as per the requirement of the present study.

7.2. Sampling Design

Sample Size: 59, Time Duration – 3 Month

Variable used for the study:

Dependent Variable: Quantity, Storage, Frequency of collection, Time of collection, Cost, Space, Lack of knowledge about scientific disposal

Independent Variable: Bio-Degradable waste

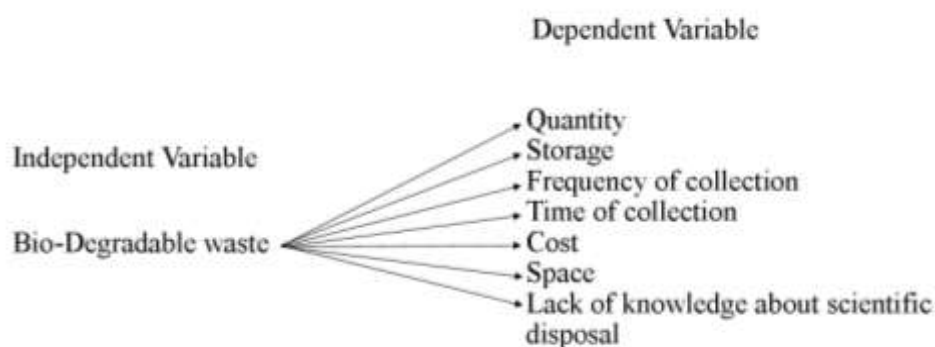


Figure 1. Variables

7.3. Data Analysis Techniques

- Percentage analysis, Weighted average method, and Ranking methods.

VIII. LIMITATIONS OF THE STUDY

1. The study is carried out only within the geography of the Kothanur area.
2. This study is focused only on household biodegradable waste.

IX. ANALYSIS

Analysis of the effectiveness of the present waste management system in Bengaluru to maintain a sustainable environment is done by testing the respondents' satisfaction level in terms of the various factors related to biodegradable waste collection.

9.1. Satisfaction level in connection with the service provided by the collecting agents.

Customer satisfaction is measured based on cumulated values from all the weighted sum of individual values. If all the customers are highly satisfied, the index will register an aggregated value of $N \times I \times 5$. The satisfaction value lies between zero and one.

N = number of respondents

I = Indicators

5 = weight assigned to extremely satisfied response

Table 1. Analysis of satisfaction level of the respondents

Basics	Extremely Satisfied (5)		Satisfied (4)		Neutral (3)		Dissatisfied (2)		Extremely Dissatisfied (1)	
	No.	W.V	No.	W.V	No.	W.V	No.	W.V	No.	W.V
Frequency of collection	12	60	22	88	14	42	6	12	5	5
Time of Collection	7	35	21	84	20	60	4	8	7	7
Cost	9	45	23	92	21	63	2	4	4	4
Service Quality	12	60	21	84	17	51	3	6	6	6

Approach	8	40	24	96	17	51	4	8	6	6
Total	48	240	111	444	89	267	19	38	28	28
Aggregate Weighted Value=59*5*5=1475										
Weighted total value related to the table=1017										

(Source: Primary Data)

Table 1 shows the respondents' satisfaction level in connection with the service provided by the collecting agents.

Where,

The number shows the total number of responses.

W.V =Weighted Value

In this study, the satisfaction level is measured based on values lies between zero and one. The values 1,.75,.5,.25 and 0 are respective values for Extremely Satisfied, satisfied, neutral, dissatisfied and extremely dissatisfied; Since we have given the weight 5,4,3,2 and 1 for these satisfaction levels.

In the case of the present respondents, satisfaction level lies between .75 and .5, i.e., .689. So, we can consider them as moderately satisfied respondents.

9.2. Disposal methods that are using in the household

The standard disposal methods used in households to manage the biodegradable wastes are examined in Table 2.

Table 2. Disposal methods that are using in households.

Disposal methods	Yes		No		Total	
	No. of Respondents	Response (%)	No. of Respondents	Response (%)	No. of Respondents	Response (%)
Source separation	36	61	23	39	59	100
Composting	11	18	48	82	59	100
Practice of 3R	17	28	42	72	59	100

(Source: Primary Data)

The table shows that 61% of the respondents doing source separation., 18% of the respondents doing the composting process, and 28% of the respondents are following Reuse, Reduce and Recycle or 3R practice in their households.

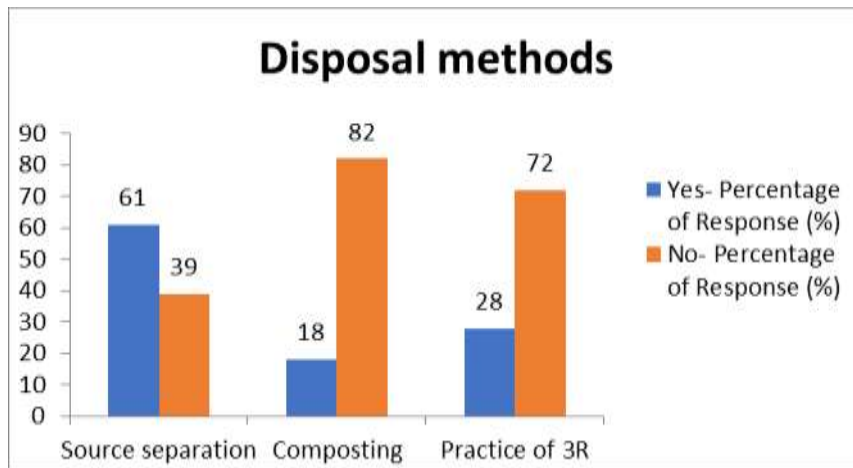


Figure 1. Disposal methods

(Source: Primary Data)

9.3. The major household Bio-Degradable waste generated.

Table 3. The major household Bio-Degradable waste generated.

Rankings (1 = highest, and 8 being the lowest)

Basics	T	1	R	2	R	3	R	4	R	5	R	6	R	7	R	8	R	TR
Vegetables	59	26	26	11	22	10	30	3	12	1	5	3	18	1	7	4	32	152
Fruits	59	10	10	13	26	14	42	2	8	8	40	4	24	3	21	5	40	211
Flowers	59	8	8	6	12	16	48	1	4	6	30	5	30	1	7	16	128	267
Paper	59	13	13	10	20	14	42	6	24	6	30	1	6	4	28	5	40	203
Cloth	59	11	11	6	12	11	33	1	4	3	15	3	18	5	35	19	152	280
Wood	59	13	13	4	8	11	33	0	0	2	10	3	18	3	21	23	184	287
Sack	59	8	8	13	26	8	24	5	20	2	10	4	24	4	28	15	128	268
Other kitchen wastes	59	16	16	14	28	16	48	5	20	4	20	2	12	0	0	2	16	160

(Source: Primary Data)

Table 3 shows the different types of bio-degradable waste generated in the household and the respondents ranking based on the quantity of waste generated.

Where,

T= Total Number of Respondents

R=Rank based on number of responses

TR=Total Rank for each type of waste

As one is the highest-ranking and 8 is the lowest ranking, from the above table, we have to consider the items with the lowest rankings that symbolize that particular waste is generated more in the households. In contrast, items which are ranked highest symbolizes that it is less generated.

The table shows that vegetables have the lowest ranking (152) amongst all other bio-degradable waste, which means the households generate more vegetable waste. Whereas wood (287) and cloth (280) are ranked highest, households generate the least amount of such waste. Other than vegetables, the next highest waste generated item is other kitchen waste (160).

9.4. Management of the household biodegradable waste without storage facilities

It is also essential to check how the households manage biodegradable waste without storage facilities or when the storage is full.

Table 4. Management of the household biodegradable waste without storage facilities

Ways of Management	Number of Respondents	Percentage of Responses (%)
Throw/Dump it in an open space, in sewerage or on the street	18	30.8
Dig a hole at the back of the house and burn it	2	3.8
Dispose of in the backyard of the house by burying the wastes	7	11.5
Throw it by the roadside	6	7.7
Throw it into the nearby river	0	0
Provide to the waste collectors	21	36
Prepare compost from wastes	4	7
Recycle and reuse the wastes	1	3.2
Total	59	100

(Source: Primary Data)

Table 4 shows that the majority of the respondents (36%) provide household waste to the collectors. 30.8% of the respondents dump waste in an open space, in sewerage or on the street. 11.5% of the respondents dispose of the house's backyard by burying the wastes. 7.7% of the respondents throw the waste on the roadside. It is also noted that 7% of the respondents prepare compost from wastes. 3.8% of the respondents dig a hole at the back of the house and burn it. Only 3.2% of the respondents recycle and reuse wastes. The diagrammatic presentation of the data is given in Figure 2.

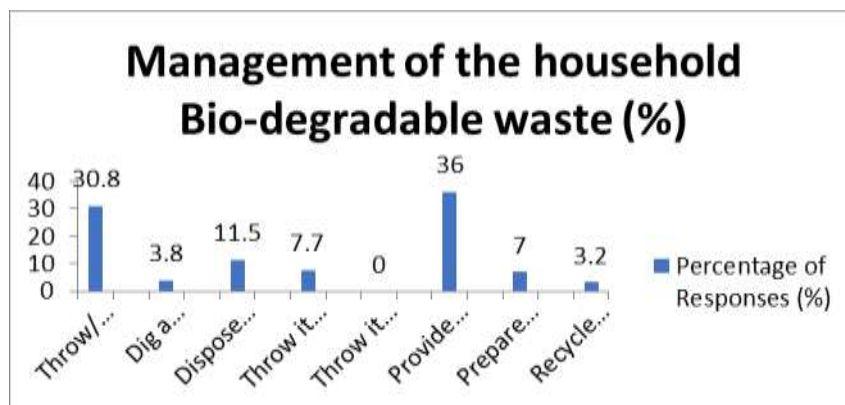


Figure 2. Management of the household Bio-degradable waste

9.5. Problem faced by the respondents while disposing of the biodegradable household waste.

It is also necessary to analyze the various problems faced by the household in disposing of biodegradable waste. Table 5 shows the various problems faced by the respondents of this study.

Table 5. The problem faced by the respondents while disposing of the biodegradable household waste.

Problems	Number of Respondents	Percentage of Response (%)
Storage	15	25.42
Frequency of collection	12	20.34
Time of collection	13	22.03
Cost	8	13.56
Lack of knowledge about scientific disposal	11	18.65
Total	59	100

(Source: Primary Data)

From the table, it is evident that 25.42% of the respondents have storage problems, whereas 22.03% of the respondents face an issue with the time of collection. 20.34% of respondents stated that frequency of collection is also a significant problem. Lack of knowledge about scientific disposal is also expressed as a severe problem by 18.65% of the respondents. Only 13.56% of the respondents considered cost as a significant problem. The diagrammatic presentation of the data is given in Figure 3.

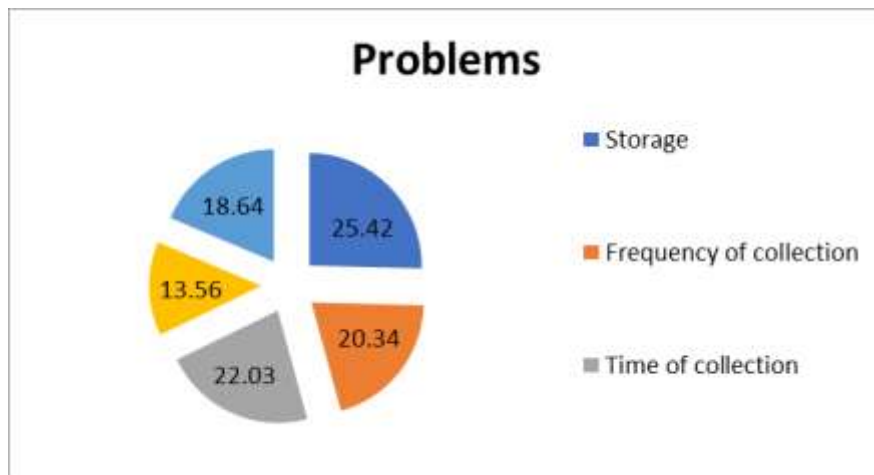


Figure 3. Problems

(Source: Primary Data)

X. FINDINGS

- In this study, the satisfaction level is measured based on values that lies between zero and one. The values 1, .75, .5, .25 and 0 are respective values for Extremely Satisfied, satisfied, neutral, dissatisfied and extremely dissatisfied; Since we have given the weight 5, 4, 3, 2 and 1 for these satisfaction levels. In the case of the present respondents, satisfaction level lies between .75 and .5, i.e., .689. So, we can consider them as moderately satisfied customers.

- It is found that 61% of the respondents doing source separation. 18% of the respondents doing the composting process, and 28% of the respondents following the practice of Reuse, Reduce and Recycle or 3R practice in their households.

- Vegetables have the lowest ranking (152) amongst all other bio-degradable waste, which means the households generate more vegetable waste. Whereas wood (287) and cloth (280) are ranked highest,

which means the households generate the least amount of such waste. Other than vegetables, the next highest waste generated item is other kitchen waste (160).

- It is found that the majority of the respondents (36%) provide household waste to the collectors. 30.8% of the respondents dump waste in an open space, in sewerage or on the street. 11.5% of the respondents dispose of the house's backyard by burying the wastes. 7.7% of the respondents throw the waste on the roadside. It is also noted that 7% of the respondents prepare compost from wastes. 3.8% of the respondents dig a hole at the back of the house and burn it. Only 3.2% of the respondents recycle and reuse wastes.

- The majority (25.42%) of the respondents are having storage problem whereas, 22.03% of the respondents facing issue with the time of collection. 20.34% of respondents stated that frequency of collection is also a significant problem. Lack of knowledge about scientific disposal is also expressed as a severe problem by 18.65% of the respondents.

XI. SUGGESTIONS

- It is always advisable to create a separate mobile app to make follow up regarding the waste collection. It will also help track the service request, frequency of collection, and timing of collection and ensure proper monitoring of collecting agents.

- Setting up a customer care unit by the authorities can also reduce the issues related to household waste management.

- Segregation of waste, disposal and management of waste should be a practical curriculum from schools itself.

- The public should be aware of various types of bio-degradable wastes and related concerns. Hygiene measures should be broadcasted to educate residents about appropriate ways of dealing with bio-degradable waste to keep the surroundings clean.

- Training programmes can be given to residents of the Kothanur area to enable them to treat their bio-waste in a sustainable manner.

- Waste can also be used as fertilizers to support kitchen gardens, terrace gardens, and even gardens that are in the vicinity.

XII. CONCLUSION

Environmental properties offer a range of opportunities for economic and social inputs. The economic resource base, in general, has been known for centuries to provide critical raw materials and inputs. Second, the ecosystem tends to consume and recycle our waste materials (often at minimal or no cost to society). This role is getting greater attention now, particularly with the way we treat sewage. India has a vast number of technical experts but lacks a well-qualified workforce that understands the appropriate procedures to manage the waste scientifically. India is struggling to know how to address waste management problems compared to other developed nations adequately. Obstruction in the current waste management makes India stay behind while comparing to other countries sustainable and advanced waste management system. If constructive steps are taken to manage the bio-degradable wastes, it will help the community to grow. It includes effective recycling of the waste for alternative use. According to the bio-degradable waste type, it should be segregated, and effective utilization should be practised, which will generate employment and revenue. The administration should review the disposal system from time to time; whenever there is new construction of the house or commercial place, the capacity to manage and dispose of the waste should be upgraded. In this digital era, even waste management can be incorporated with modern software and technology. From the present study, there is a lack of understanding of scientific waste management among households. Irregular collection of waste and lack of scientific storage facilities creates problems in day-to-day life. The majority (59.3 %) of the household have the provision for disposing of their waste through an organized collecting agency, whereas the remaining (41.7 %) does not have any access to dispose of their household bio-degradable waste through the collecting agency, such kind of issues need to be addressed by the authority and civic bodies.

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