

SUSTAINABLE DEVELOPMENT: A CASE STUDY ON HOUSEHOLD

FOOD WASTE MANAGEMENT

NAME OF THE CANDIDATE: K.SELVA PRIYA

REGISTER NO: 4010160

MASTER OF BUSINESS ADMINISTRATION



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600119



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Accredited with “A” grade by NAAC I 12B Status by UGC I

Approved by AICTE Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai – 600 119

www.sathyabama.ac.in

ADMINISTRATION

BONAFIDE CERTIFICATE

This is to certify that this project report is the bonafide work of
K.SELVA PRIYA (40410160) who has done the project work entitled
“Impact of social media in brand building of a start-up company”

Under my supervision for a month

DR. Bhuvaneswari.G

INTERNAL GUIDE

Dean – School of Business Administration

Submitted for Viva voice Examination held on

INTERNAL EXAMINER

EXTERNAL EXAMINER

DECLARATION

I, K. Selva Priya (40410160), hereby declare that the project report entitled “**Sustainable development: A case study on household food waste management**” done by me under the guidance of Dr.

Bhuvaneswari.G., Assistant Professor, School of Business Administration is submitted in partial fulfilment of the requirements for the award of Master of Business Administration degree.

DATE: 08/04/2022

NAME: SELVA PRIYA .K

PLACE: CHENNAI

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of SATHYABAMA for their kind encouragement in doing and for completing it successfully. I am grateful to them.

I convey my sincere thanks to DR. Bhuvaneswari.G., Dean, and School of Business administration for providing me necessary support and details at the right time during the progressive reviews.

I wish to express my thanks to all teaching and non-teaching staff members of the school of Business Administration who were helpful in many ways for the completion of the project.

K.SELVA PRIYA

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ABSTRACT

Proper food waste management is a fundamental key to environmental sustainability. In recent years, food waste has received growing interest from rural and urban areas, NGO'S as well as international organizations from various disciplinary fields. Increasing concerns about food security and environmental impacts, such as resource depletion and greenhouse gas emissions attributed to food waste, have intensified attention to this research. While food waste occurs in all stages of the food supply chain, households have identified as key actors in food waste generation. This paper briefs the still small but expanding academic territory of consumer food waste by reviewing studies and the answers of the people on food waste management and impede the generation of food waste on the household level. This research briefly analyses the food waste in household and their sustainability factors.

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12	How often the waste container emptied
13	Have you ever been educated on proper waste disposal by council?
14	In either of the way have you heard of waste management?
15	Do you think the waste disposal method is a problem in your neighborhood?

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CHAPTER – 1

INTRODUCTION

1.1 INTRODUCTION

Food waste at the household level represents a major component of all food waste. Therefore, minimizing food waste at the household level remains an important component of the food chain responsibility. This study explores the problem of food waste. This includes the generation of food waste on the household and waste disposals in villages. Waste management refers to the practice of collecting, managing and monitoring various waste materials. It is important to observe sustainability in this aspect so that every bit of waste managed in an efficient manner rather than just dumping it all in landfills.

Sustainable waste management refers to the collection, transportation, valorization and disposal of the various types of waste, in a manner that does not jeopardize the environment, human health or future generations. It includes any activity involved in the organization of waste management, from production to the final treatment. It is important to note that there are various types of wastes, such as municipal, which includes household, commercial and demolition waste; electronic or e-waste, which includes computer parts; and radioactive waste, among many other forms of waste.

The goal of sustainable waste management is to reduce the amounts of natural resources consumed, reusing the material taken from nature as much as it is possible, and creating as minimal waste as possible. It is our responsibility to maintain sustainability for the benefit of our environment as well as future generations. A well- functioning sustainable waste management system, focus on processes, embody adaptability and divert wastes from the disposal. Sustainable waste management is a key concept of the circular economy and offers many opportunities and benefits to both the economy, the society and the environmental.

Sustainable waste management involves collecting, sorting, treating, recycling, and when properly facilitated providing a source of energy and resources. It, therefore, creates jobs, improves waste management methods, and lessens the impact of human activities on the environment,

thereby, improving the air and waste quality. It also reduces food wastage, keeps heavy environmental costs at bay, and prevents some human health condition, thereby improving the overall human life. This is, however, still a relative paucity of field research on the subject of consumer-generated food waste in the context of private households.

Despite a growing number of studies, little is about the determinants of consumer food waste and the underlying factors that encourage drive or impede food waste behaviors and practices. A closer look at households brings to light that the issues of food waste and sustainable practices around food are multifaceted. Given its complex nature, the evidence on drivers of food wastage and barriers to its reduction remains scattered.

Thyberg and Tonjes have provided a literature review of the causes of food waste, which concentrates on cultural, political, economic, and geographic drivers, with a particular focus on the US. However, a truly systematic review that covers research from social sciences in particular, and delivers a comprehensive map of the intellectual territory of the main reasons for food wastage occurring on the household level, remains absent.

Many studies have tackled the performance of municipal food waste management schemes through life cycle assessment and costing. However, few studies performed a holistic sustainability assessment encompassing environmental, economic and social pillars using primary, site-specific data and involving local stakeholders in the definition of the sustainability framework as recommended by best practices. Despite the numerous frameworks proposed in the literature, data collection challenges and possible other factors have limited the number of analytical studies.

Moreover, for the specific case of household and municipal food waste, no such studies are available. Reviewing the literature, we identified four main issues that can further enhance the full implementation of sustainability frameworks. This first issue is a systematic stakeholder involvement in identifying the relevant impact categories to be included in the framework. We found only a few studies that clearly documented a systematic involvement of the stakeholders in singling out the relevant impact categories for the case under assessment e.g. through dedicated questionnaires or workshops.

Waste arises in many different forms and its characterization can be expressed in several forms. Some common characteristics used in the classification of waste includes the physical states, physical properties, reusable potentials, biodegradable potentials, source of production and the degree of environmental impact. White et al. 1995 started the waste can be classified broadly into three main types according to their physical states; these are liquid, solid and gaseous waste. Although it is clear that several classifications exists in different countries.

The most commonly used classifications are illustrated below.

- Physical state
 -  Solid waste
 -  Liquid waste
 -  Gaseous waste
- Source
 -  Household/Domestic waste
 -  Industrial waste
 -  Agriculture waste
 -  Commercial waste
 -  Demolition and construction waste
 -  Mining waste
- Environmental impact
 -  Hazardous waste
 -  Non-hazardous waste

Due to the limited scope of the research study; liquid waste, which can be disposed of via sewer networks or lost to ground water, and hazardous wastes, which require tighter environmental controls, because of their potential to cause environmental harm, are excluded. Only solid waste will be discussed in detail, excluding hazardous solid waste.

WASTE MANAGEMENT

Human interactions with the environment have always resulted in waste production. However, Giusti reported that waste production and management was not a major issue until people began living together in communities. Vergara and Tchobanoglous reported that as population and purchasing power of people increases worldwide, more goods are produced to meet increasing demand, thereby leading to the production of more waste. Marchettini et al. pointed out that ,these continuous flow of waste resulting from human activities, overburdened the environment.

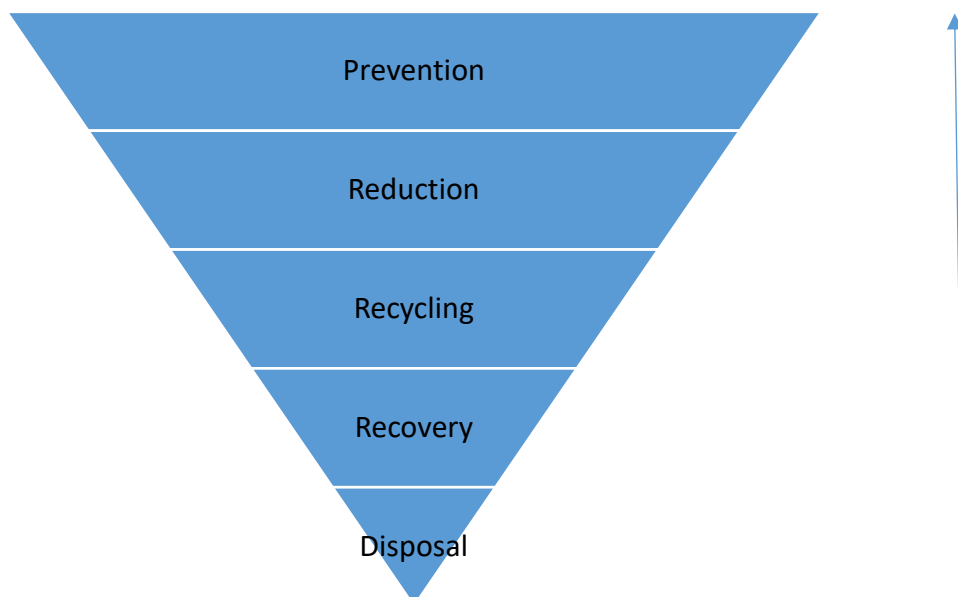
SUSTAINABLE DEVELOPMENT

In order to minimize the negative impacts of your event you should follow the very simple mantra of reduce, reuse and recycle.

Ideally you will make the most efficient use of resources by minimizing demand on primary sources and maximizing the re use, recycling, and recovery of all the event materials instead of sending them to a landfill.

The waste management hierarchy below is the process you ideally should always

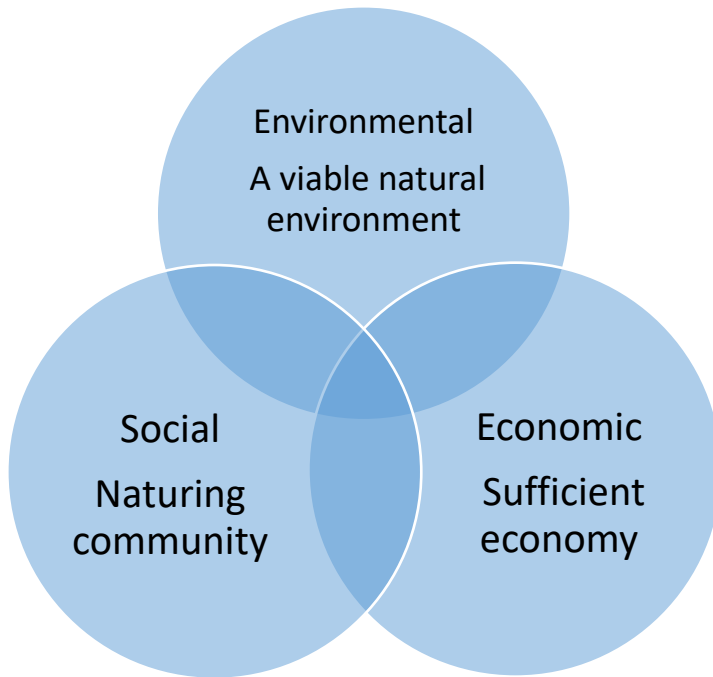
Follow



Importance of Sustainable development

Sustainable development always encourages us to conserve and enhance our resources, by gradually changing the manners in which we develop and use technology. All countries should meet the basic needs of employment, food, energy, water and sanitation

Everybody is rightful to a healthy, safe and clean environment.



1.2 NEED FOR THE STUDY

- Food is the largest component of household waste.
- Children are dying of hunger while we throw our food.
- More than one third of the average household garbage bin filled with food waste each week.
- Emission of toxic gases when waste food dumped in landfills.
- Dumping makes soil infertile.

1.3 SCOPE OF THE STUDY

- Routine human activities affect the environment and the consumption of natural materials and energy resources.
- The challenge to society is to minimize these impacts, maintain an acceptable quality of the environment, and sustain the quality of life and resource supplies for future generations.
- The generation of household food waste is inevitable because all products have an end of life.
- Humans and animals create wastes that have to be managed to maintain hygienic, healthy and tidy urban and open country environments.
- To prevent harmful substances to remain and potentially accumulate in these material loops.
- To make sure that household wastes that are generated are recyclable.
- To strongly appeal for researchers to contribute towards improving waste management all over the world.

1.4 OBJECTIVES OF THE STUDY

- To understand the importance of household food waste management.
- To assess the quantity of food waste generated in households.
- To recycle the waste after to the extent possible.
- To analyze their disposal methods.

1.5 LIMITATIONS OF THE STUDY

- The research conducted within a limited duration. So a detailed and comprehensive study could not be made.
- The sample was confined to 300 respondents. So this study can be regarded as “fool proof” one.
- Unequal number of males and females.
- Surveys are not as easy as the domestic surveys as certain errors do crop in.
- The findings and conclusions are based on knowledge and experience of the respondents.

CHAPTER – 2

REVIEW OF LITERATURE

- John Paul Castillo Vallente, Mark Raguindin Limon and Neil Christian T. Corales (2020) Solid waste management beliefs and practices in rural households towards sustainable development. This study examined the waste management beliefs and practices of rural households when it comes to solid waste management. It was also found that minimal effort is done in reusing and recycling of waste materials among households.
- Davide Tonini (2020), Quantitative sustainability assessment of household food waste management in the Amsterdam Metropolitan Area, This study quantifies the sustainability of the status quo and five alternative household food waste management scenarios for the case of the Amsterdam Metropolitan Area.
- (Aye & Widjaya, 2006), the management of waste become complex and the facilities provided cannot cope with the increasing demand and needs. Therefore, best approach need to be implemented immediately while considering environmental, social and economic aspect .The drivers of sustainable waste management were clarified by Agamuthu et al. (2009), which include human, economic, institutional and environment aspect. The study suggests that each driving group should be considered in local context as managing solid waste for a particular society may differ from the others.
- (Couth & Trois, 2010), waste managers in Africa need to tackle some issues including, lack of data, insignificant financial resources, vast different of amount and waste types between urban and rural area, lack of technical and human resources, low level of awareness and cultural aversion towards waste .On the other hand, problems faced among Asian countries differ with two distinct groups; developed and developing countries. While some of the countries are having specific national policy on solid waste management, some others experience problems such as increasing urban population, scarcity of land, services coverage area, inadequate resources and technology, and so on (Shekdar, 2009).

- (Berkun et al., 2005), the differences in managing solid waste not only vary between countries but also among areas in the same country. For instance, while Istanbul are having big improvement in their solid waste management with the establishment of transfer stations, sanitary landfills and methane recovery system, it does not reduce the problem in the Black Sea coast in Turkey. This is caused by the complex topography, weak administrative structures and the low local's income.
- (Van de Klundert, 1999) Integrated Sustainable Waste Management (ISWM) system was then introduced in 1995 to improve earlier system that neglect unique characteristics of a given society, economy and environment. For example, European countries had applied various system assessment tools and engineering models to create sustainable communities, manage resources efficiently, tapping innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion in their SWM system (Pires et al., 2011). Asian countries had also given attention in building the national legal frameworks, managing institutional, technology, operational and financial aspects, and creating public awareness and participation.
- (Kathiravale & Mohd Yunus, 2008) Developed countries generate more waste than developing countries. Countries in Asian and African region produce waste in the range of 0.21-0.37 tons/capita/ year, while European countries generate higher amount of waste with 0.38-0.64 tons/capita/ year (Intergovernmental Panel on Climate Change [IPCC], 2006).
- (Idris et al., 2004) The generation of waste is also reported to be associated with the economic status of a country. In Asia, countries with higher GDP, namely Hong Kong and Japan were reported to generate more waste compared to developing countries such as India, Vietnam and Nepal (Shekdar, 2009). Waste composition from these countries also differs where rural areas often produce more organic waste and fewer recyclable items.
- (Hazra & Goel, 2009; Bai & Sutanto, 2002) Developed countries are experiencing high waste generation while developing countries always have problems with the implementation of the management system.
- (Agamuthu et al., 2009) This includes weak enforcement, lack of technology and ineffective policy implementation. In detail, these countries experience low and irregular collection of waste, uncontrolled of air and water pollution in open dumping area, the breeding of flies and vermin, and the mismanagement of scavenging activities.

- (Morra et al., 2009; Liu & Morton, 1998) Information on waste generation is important to determine the most suitable waste disposal options. Improper waste disposal may cause pollution. The main purpose in implementing best practice for solid waste management is to prevent pollution. Pollution is a threat to human and other living organism.
- (Raga et al., 2001) It may also damage the ecosystem and disrupt the natural cycle and climate on earth. There are many disposal options available to suit the nature of waste and a country's preference and interest.
- (Aye & Widjaya, 2006; Daskalopoulos et al., 1997) Economics and environmental aspects of waste disposal option are always the main issue in choosing the right technology.
- (Agamuthu & Fauziah, 2010; Shekdar, 2009; Bai & Sutanto, 2002) Developed Asian countries such as Japan, South Korea and Singapore are on their way to eliminate landfilling while some other Asian countries still have problems with open dumping. Despite the development of many waste disposal option, landfills remain the most prominent system applied worldwide
- (Hamer, 2003) Although a lot of improvement had been possible in the landfilling system and the regulation on the type of waste that can be treated at landfill is stringent, most of landfills operated remain primitive.
- Ayomoh et al. (2008) had listed few problems related to improper landfill operation including, health deterioration, accidents, flood occurrences, pollution of surface and underground waters, unpleasant odor, pest infestation and gas explosion. Although the impacts from landfills are known, impacts from other alternative remain unanswered thus subject to critics.
- (Zou, 2009; Duxbury et al., 2000) Ocean dumping was a common practice before countries over the globe began to ban the activities in 1980s. Even after the prohibition, dumping into water bodies persist in the area where waste collection service is not received.
- (Inanc et al., 2004) In some regions, although there are designated dumping areas for slaughterhouse, hazardous and biomedical waste, the legislation are ineffective to curb illegal dumping onto water bodies. To make it worse, waste previously dumped from ports and waterways had found their way back to the beaches years after the implementation of the legislation on ocean dumping.

- (In 2007 Sharholy and Ahmad) gives a review report over Municipal solid waste management in Indian cities. In his report, they discuss about the Qualitative and quantitative analysis, characteristics and composition, Storage and collection, Transfer and transport, disposals and treatment of Municipal Solid Waste. The study concluded with a few fruitful suggestions, which may be beneficial to encourage the competent authorities/ researchers to work towards further improvement of the present system.
- (Vikash and Shreekrishnan 2008) evaluate the present state of municipal solid waste management in Delhi. Since Delhi is the most populated and urbanized city in India about 3.85% 3.85%, almost double the national average. Delhi is also a commercial hub, providing employment opportunities and accelerating the pace of urbanization, resulting in a corresponding increase in municipal solid waste (MSW) generation.
- (Hazra and Goel 2009) gives an overview of current solid waste management (SWM) practices in Kolkata, India and suggests solutions to some of the major problems. More than around 2920ton/day of solid waste are generated in Kolkata Municipal Corporation, 60- 70% are collected with the deficient in terms of work force and vehicle availability. In addition, conclude Lack of suitable facilities (equipment and infrastructure) and underestimates of waste generation rates, inadequate management and technical skills, improper bin collection, and route planning are responsible for poor collection and transportation of municipal solid wastes.
- (Seema 2010) focus into the clean development mechanism (CDM) projects involving energy recovery from municipal solid waste (MSW).in her work comprising of Municipal problems, regulatory framework in place and the CDM opportunities in India, also explain RDF, composting and landfill gas recovery methods. Comparative Case study is also taken in consideration between Brazil and India and revealed that the India does not have well designed sanitary landfills where methane can be captured. India needs to make conscious effort towards developing more scientific landfills, capture methane and take carbon credits.

- (Dimpal 2012) presents a report on Urbanization and solid waste management in India. In his report, she describes how the urbanization High rate of population growth, declining opportunities in rural areas and shift from stagnant and low paying agriculture sector to more paying urban occupations, largely contribute to urbanization The unexpected immigration has also caused the burgeoning of slums and the growth of squatters and informal housing all around the rapidly expanding cities of the developing world.
- (Papargyropoulou et al., 2016) Pre-consumer waste occurs at the production level, and post-consumption waste occurs at the consumer level. Scholars argue they associate different factors with food waste generation at these stages. Accordingly, various mitigation approaches perhaps can reduce such waste.
- (Blondin et al., 2017) revealed that, in the USA, fluid milk waste results in 27% and 41% losses, respectively, of the vitamin D and calcium required under school breakfast programme meals.
- (Derqui et al., 2018) The opportunity that such research presents for creating a culture of sustainability and for reinforcing the pro-environment habits of future consumers by making them ecologically aware of the food system and its importance.
- (Wilkie et al., 2015) What is most worrying in this context is that, in spite of the acknowledgement of such a high quantity of waste generated, the authorities in educational institutions, food service managers in schools and university food service companies' staff are not intent on reducing food waste.
- (Smith and Cunningham-Sabo, 2014; Adams et al., 2016) An important subdomain where out-of-home dining takes place is food service establishments at educational institutions. In this context, prior studies have observed that school cafeterias are a major source of unconsumed food.

- (Martin-Rios et al., 2018) Regarding food waste generation, prior studies have indicated that a large amount of food waste is generated at the consumption stage, which includes both out-of-home and at-home dining.
- (Betz et al., 2015) Households represent at-home dining, whereas the food service sector represents out-of-home dining. The food service sector includes both non-commercial and commercial establishments, such as restaurants, hotels, health-care companies, educational institutions and staff catering.
- (Gustavsson, 2011) Food waste is an important concern because it threatens the environment and sustainability. In fact, it is a serious concern in the hospitality and tourism domain (Okumus et al., 2020). Close to 1.3 billion tonnes of edible food is wasted annually, leading to severe financial, environmental and health outcomes.
- (Derqui and Fernandez, 2017) avoidable food waste: meal scraps such as peeling or trimming waste arising from the less proficient handling of food items; overproduction for banquets, events and catering; poor ordering procedures; poor food rotation practices, causing food spoilage; and poor inventory systems, leading to food and plate waste such as unconsumed pasta.
- (Khadka, 2017) research reports suggest that, by saving one-fourth of the food being wasted, we can feed 870 million hungry people.
- (Blondin et al. 2017) revealed that, in the USA, fluid milk waste results in 27% and 41% losses, respectively, of the vitamin D and calcium required under school breakfast programme meals.
- (Hollingsworth et al., 1995) Food waste does not hold a central place in the existing debate. Other studies have focused on aspects such as the composition of waste generated in the food service operations in schools.

Looking at the waste generation trend of developed country, it believed that other transition and developing countries will experienced the same. Until recently, the generation of waste is increasing and it is believed to continue rising. This is an issue of concern for authorities all over the world. It believed that the amount of waste will continue to pile up the landfill and someday the land will not be able to receive any more waste.

3.1 RESEARCH DESIGN

- ❖ Research design refers to the framework of market research methods and techniques that chosen by a researcher.
- ❖ The design that chosen by the researchers allow them to utilize the methods that are suitable for the study and to set up their studies successfully in the future as well.

3.2 DESCRIPTIVE RESEARCH DESIGN

Descriptive research is a study designed to depict the participants in an accurate way. More simply put, descriptive research is all about describing people who take part in the study.

3.3 SOURCES OF DATA

Data collection is the term used to describe a process of preparing and collecting data.

- Primary Data – Questionnaire prepared using Google forms, which responded by 300 respondents.
- Secondary Data - Websites and online journals, Published reports & Review of literature from published articles.

3.4 STRUCTURE OF QUESTIONNAIRE

Questionnaire divided into six sections.

-  First section – Basic Information.
-  Second section – Finance capital.
-  Third section – Physical capital.
-  Fourth section – Natural capital.
-  Fifth section - Social capital.
-  Sixth section – Respondents awareness, opinion and suggestion about household waste management.

3.5 SAMPLING TECHNIQUE

3.5.1 Convenience sampling method

A convenience sample is one of the main types of non-probability sampling methods. A convenience sample is made of people who are easy to reach.

3.6 PERIOD OF STUDY

The Research done to learn about the sustainability factors of household food waste management about three months.

3.7 ANALYTICAL TOOLS

3.7.1. PERCENTAGE ANALYSIS

Research questions answered with a descriptive statistic: generally either percentage or mean. Percentage is appropriate when it is important to know how many of the participants gave a particular answer. Generally, percentage reported when the responses have discrete categories.

3.7.2. ANOVA TEST

A One way Anova is used for three or more groups of data, to gain information about the relationship between the dependent and independent variables.

3.7.3. T TEST

A t- test is a statistical test that is used to compare the means of two groups. It is often used in hypothesis testing to determine whether a process or treatment actually has an effect on the population of interest, or whether two groups are different from one another.

3.7.4. F TEST

The F-test is used by a researcher in order to carry out the test for the equality of the two population variances. If a researcher wants to test whether or not two independent samples have been drawn from a normal population with same variability.

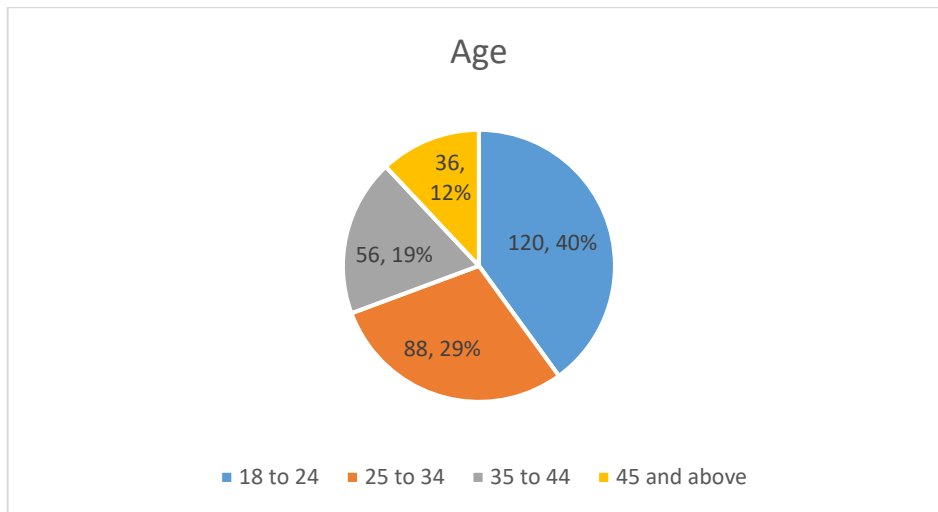
CHAPTER – 4

DATA ANALYSIS AND INTERPRETATION

TABLE NO 1: Age

AGE	NO OF RESPONDENTS	PERCENTAGE
18 to 24	120	40%
25 to 34	88	29%
35 to 44	56	19%
45 and above	36	12%
Total	300	100%

CHART NO 1: AGE



Interpretation

It is interpreted that 40% of respondents are 18 to 24, 29 % are 25 to 34, 19% are 35 to 44 and 12% are 45 and above.

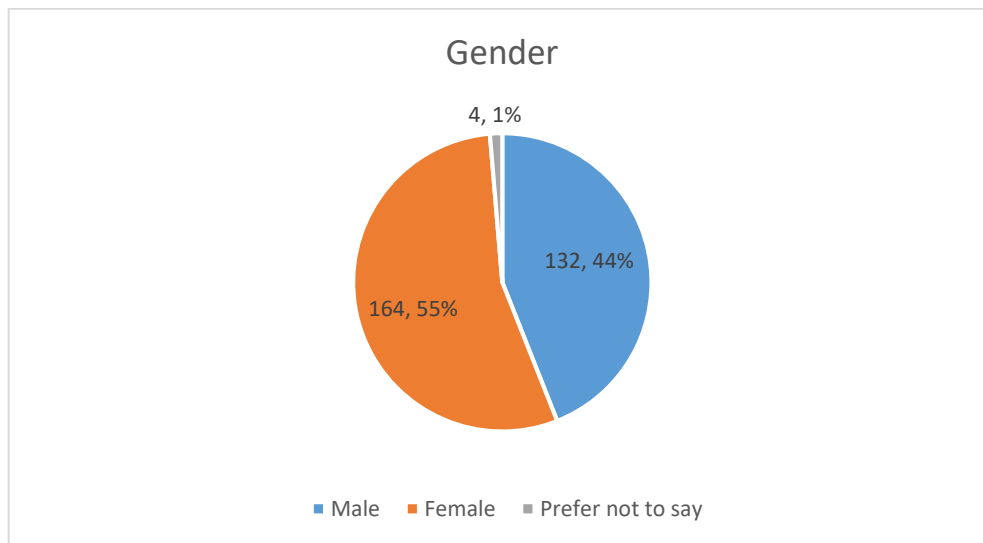
Inference

Majority 40% of the respondents are 18 to 24.

TABLE NO 2: Gender

GENDER	NO OF RESPONDENTS	PERCENTAGE
Male	132	44%
Female	164	55%
Prefer not to say	4	1%
Total	300	100%

CHART NO 2: Gender



Interpretation

It is interpreted that 55% of the respondents are Female, 44% are male and remaining 1% are prefer not to say.

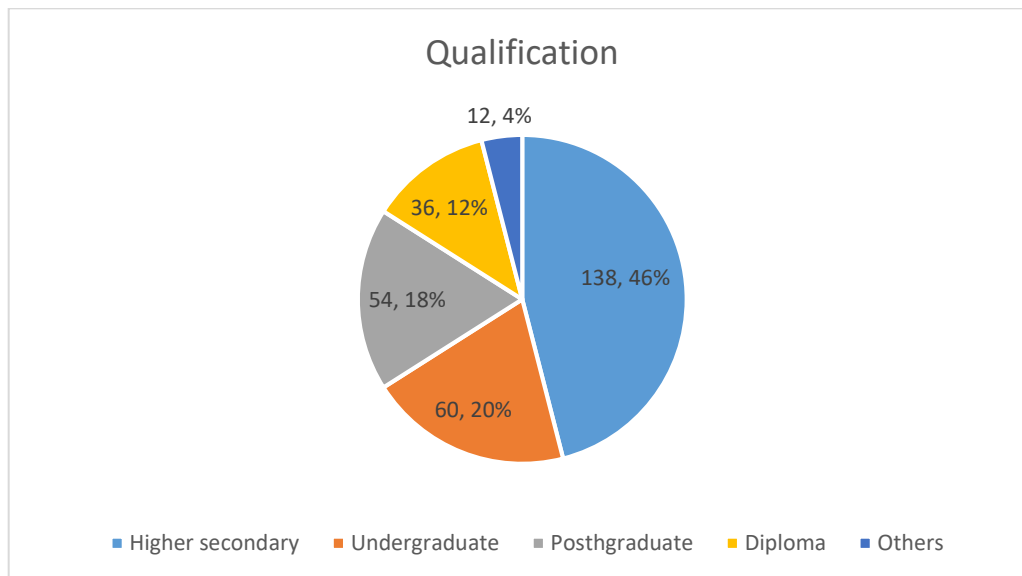
Inference

Majority 55% of the respondents are female.

TABLE NO 3: Educational qualification

QUALIFICATION	NO OF RESPONDENTS	PERCENTAGE
Higher secondary	138	46%
Undergraduate	60	20%
Postgraduate	54	18%
Diploma	36	12%
Others	12	4%
Total	300	100%

CHART NO 3: Educational qualification



Interpretation

It is interpreted that 46% of the respondents are higher secondary, 20% are undergraduate, 18% are postgraduate, 12% are diploma and 4% are others.

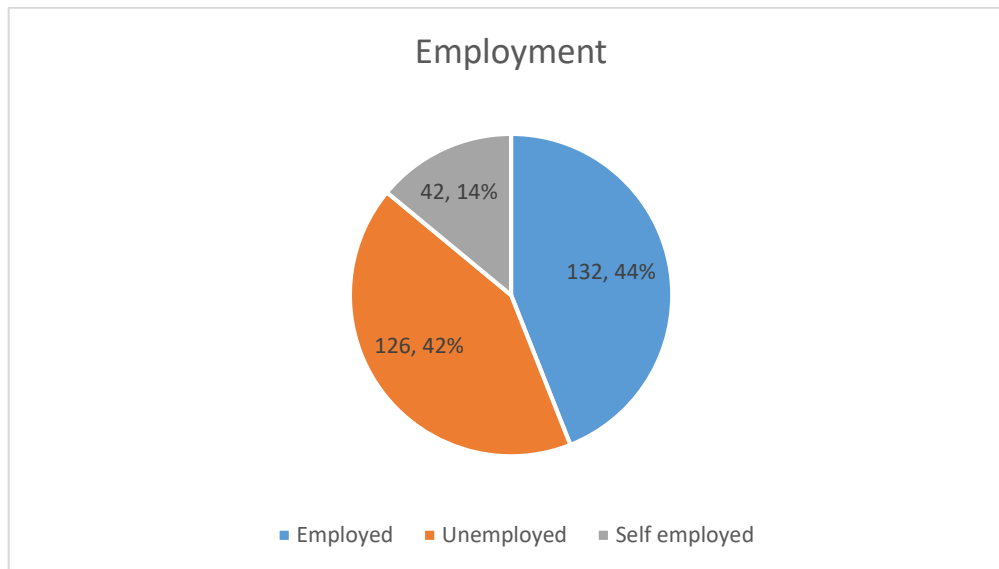
Inference

Majority 46% of respondents are higher secondary.

TABLE NO 4: Employment status

EMPLOYEMENT	NO OF RESPONDENTS	PERCENTAGE
Employed	132	44%
Unemployed	126	42%
Self employed	42	14%
Total	300	100%

CHART NO 4: Employment status



Interpretation

It is interpreted that 44% of the respondents are employed, 42% are unemployed and remaining 14% are self employed.

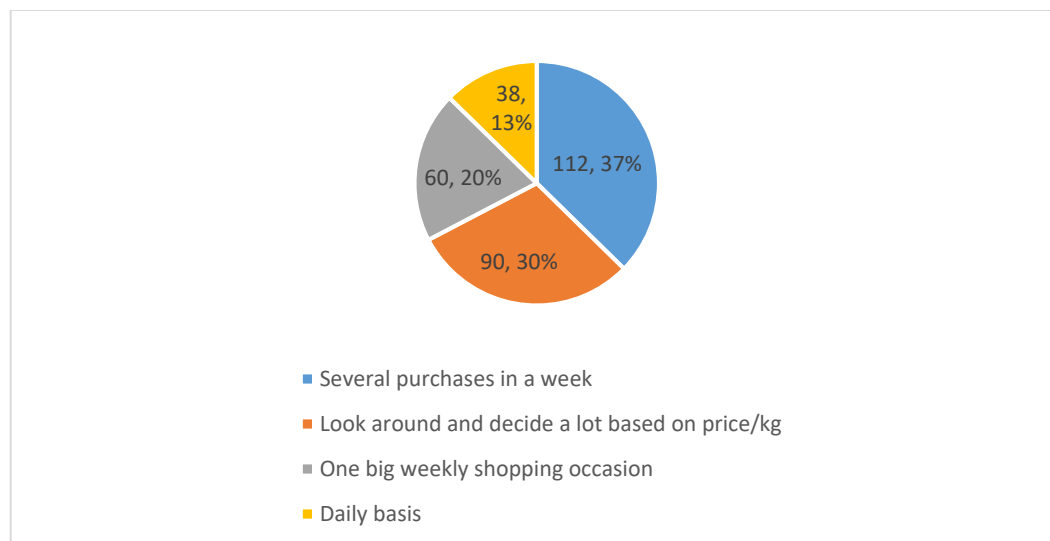
Inference

Majority 44% of the respondents are employed.

TABLE NO 5: How do you purchase your everyday commodities?

	NO OF RESPONDENTS	PERCENTAGE
Several purchases in a week	112	37%
Look around and decide a lot based on price/kg	90	30%
One big weekly shopping occasion	60	20%
Daily basis	38	13%
Total	300	100%

CHART NO 5: How do you purchase your everyday commodities?



Interpretation

It is interpreted that 37% of the respondents choose several purchases in a week, 30% choose look around and decide a lot on price/kg, 20% choose one big weekly shopping occasion and remaining 13% choose daily basis.

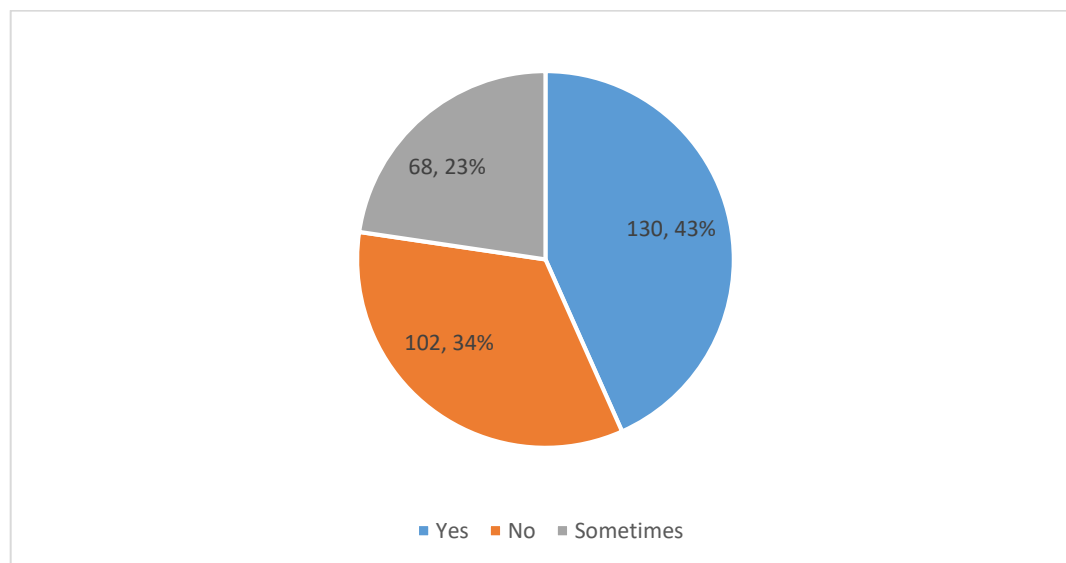
Inference

Majority 37% of the respondents choose several purchases in a week.

TABLE NO 6: Do you throw away your food?

	NO OF RESPONDENTS	PERCENTAGE
Yes	130	43%
No	102	34%
Sometimes	68	23%
Total	300	100%

CHART NO 6: Do you throw away your food?



Interpretation

It is interpreted that 43% of the respondents says yes, 34% says no and the remaining 23% says sometimes.

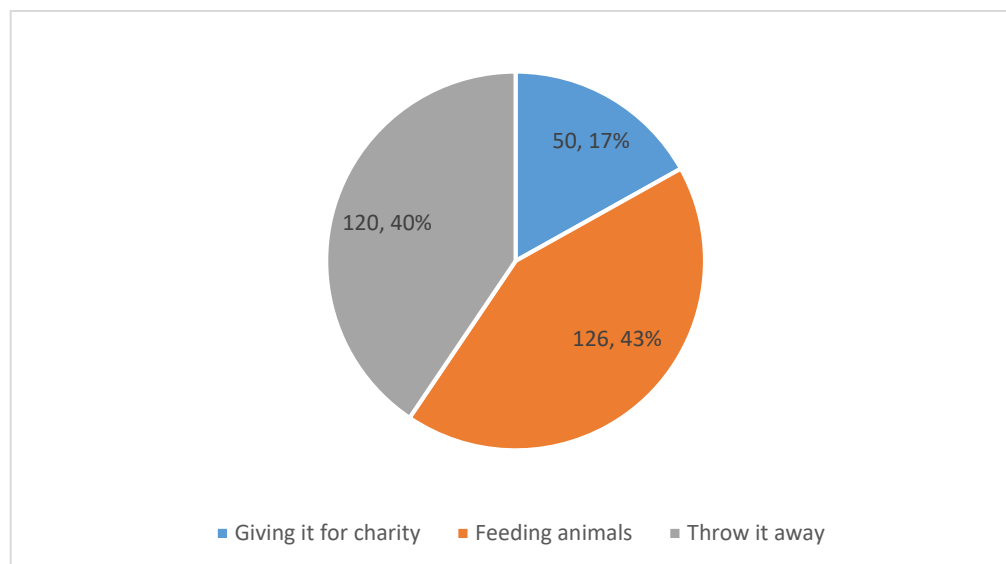
Inference

Majority 43% of the respondents says yes.

TABLE NO 7: What do you do with the leftovers of your food?

	NO OF RESPONDENTS	PERCENTAGE
Giving it for charity	50	17%
Feeding animals	126	43%
Throw it away	120	40%
Total	300	100%

CHART NO 7: What do you do with the leftovers of your food?



Interpretation

It is interpreted that 43% of the respondents are feeding animals, 40% are throwing it away and 17% are giving it for charity.

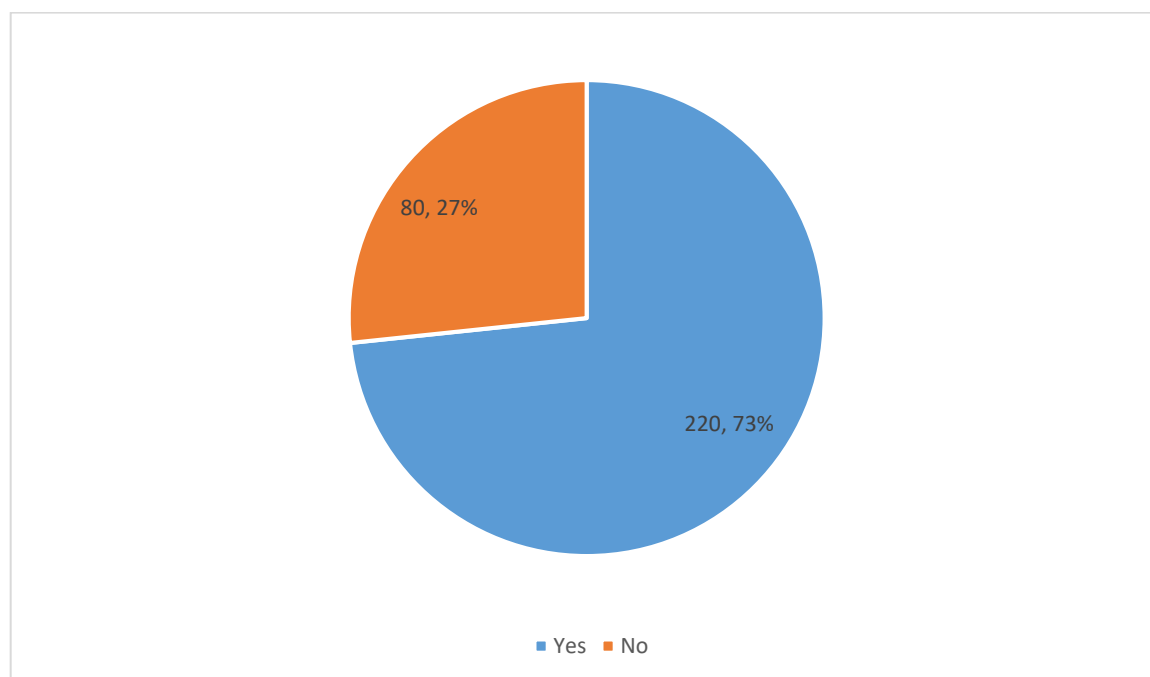
Inference

Majority 43% of the respondents are feeding animals.

TABLE NO 8: Do you know that we can transform food waste into usable products?

	NO OF RESPONDENTS	PERCENTAGE
Yes	220	73%
No	80	27%
Total	300	100%

CHART NO 8: Do you know that we can transform food waste into usable products?



Interpretation

It is interpreted that 73% of the respondents says yes and the remaining 27% says no.

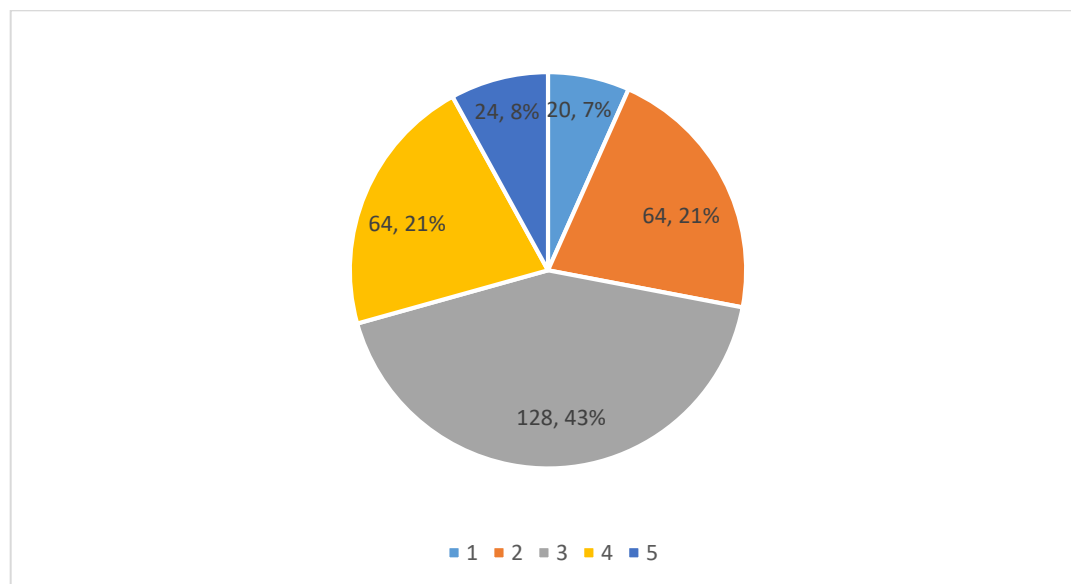
Inference

Majority 73% of the respondents says yes.

TABLE NO 9: How often do you throw away leftovers?

RATING	NO OF RESPONDENTS	PERCENTAGE
1	20	7%
2	64	21%
3	128	43%
4	64	21%
5	24	8%
Total	300	100%

CHART NO 9: How often do you throw away leftovers?



Interpretation

It is interpreted that 43% of the respondents rates 3, 21% rates 2, 21% rates 4, 8% rates 5 and 7% rates 1.

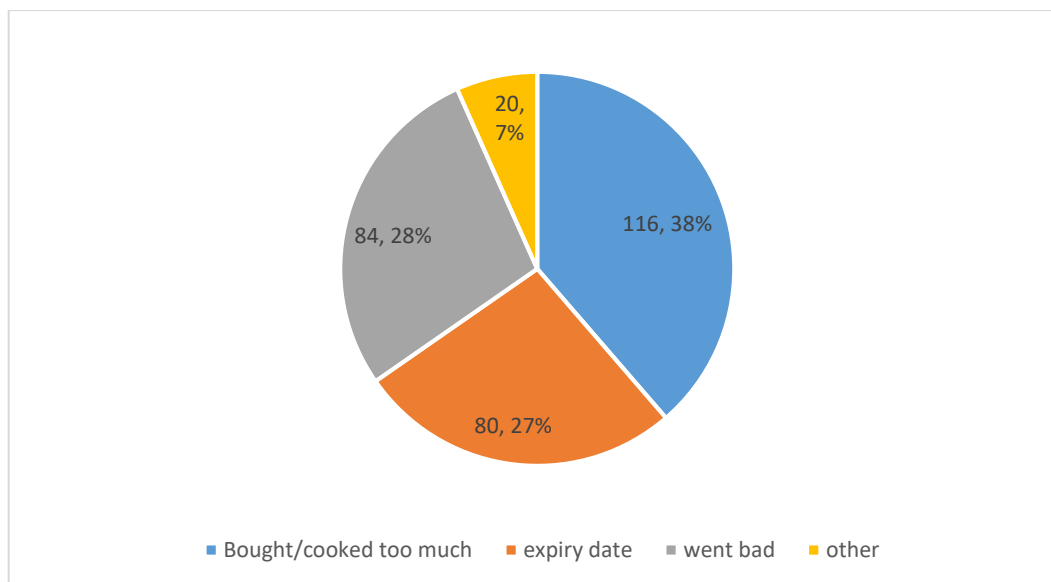
Inference

Majority 43% of the respondents rates 3.

TABLE NO 10: Why do you waste food?

	NO OF RESPONDENTS	PERCENTAGE
Bought/cooked too much	116	38%
Expiry date	80	27%
Went bad	84	28%
Other	20	7%
Total	300	100%

CHART NO 10: Why do you waste food?



Interpretation

It is interpreted that 38% of the respondents bought/cooked too much, 28% choose went bad, 27% choose expiry date and the remaining 7% choose others.

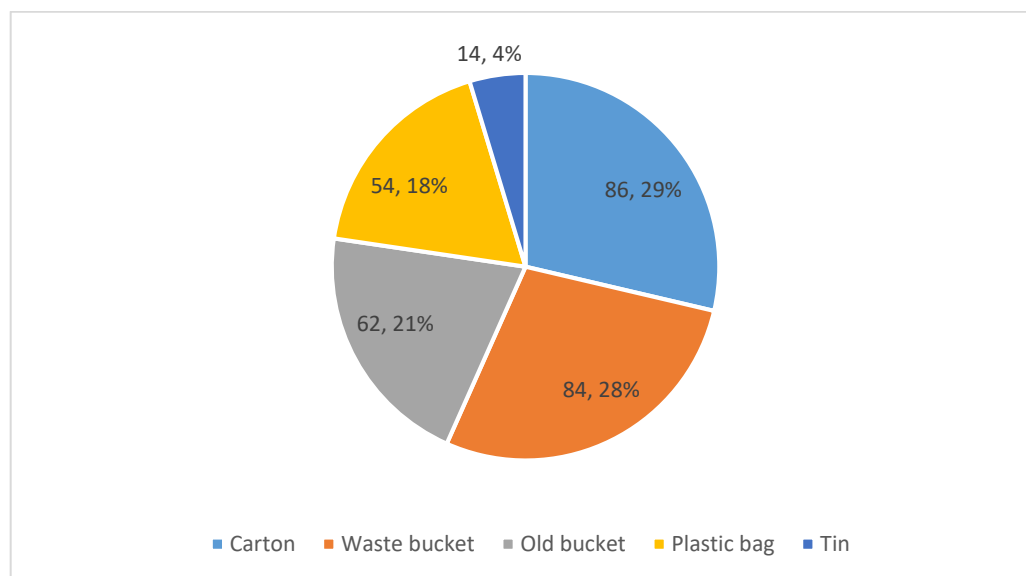
Inference

Majority 38% of the respondents choose bought/cooked too much.

TABLE NO 11: In what type of container do you collect waste food?

	NO OF RESPONDENTS	PERCENTAGE
Carton	86	29%
Waste bucket	84	28%
Old bucket	62	21%
Plastic bag	54	18%
Tin	14	4%
Total	300	100%

CHART NO 11: In what type of container do you collect waste food?



Interpretation

It is interpreted that 29% of the respondents use carton, 28% use waste bucket, 21% uses old bucket, 18% uses plastic bag and the remaining 4% uses tin.

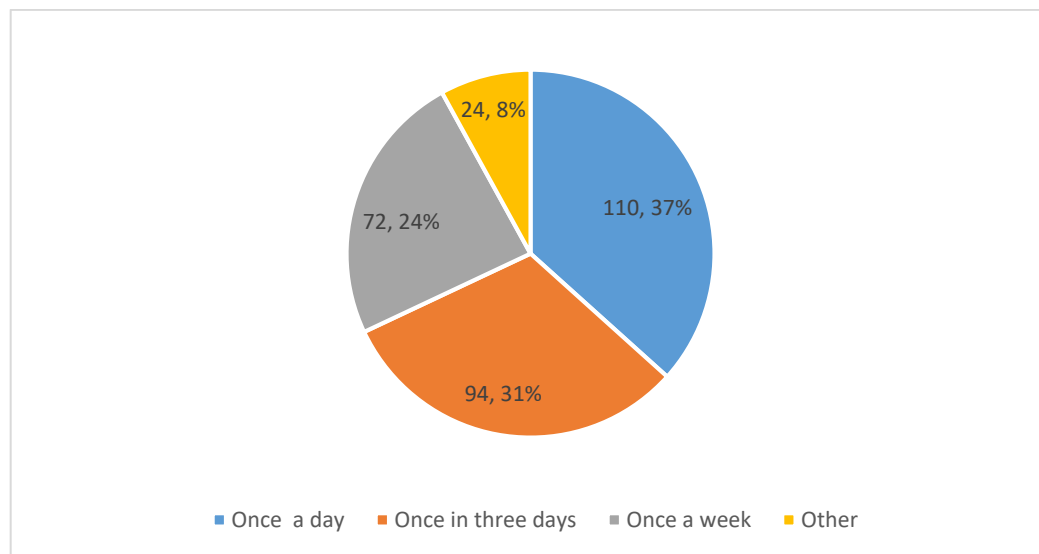
Inference

Majority 29% of the respondents uses carton.

TABLE NO 12: How often is the waste container emptied

	NO OF RESPONDENTS	PERCENTAGE
Once a day	110	37%
Once in three days	94	31%
Once a week	72	24%
Other	24	8%
Total	300	100%

CHART NO 12: How often is the waste container emptied



Interpretation

It is interpreted that 37% of the respondents' empties waste once a day, 31% empties once in three days, 24% empties once a week and 8% chooses other.

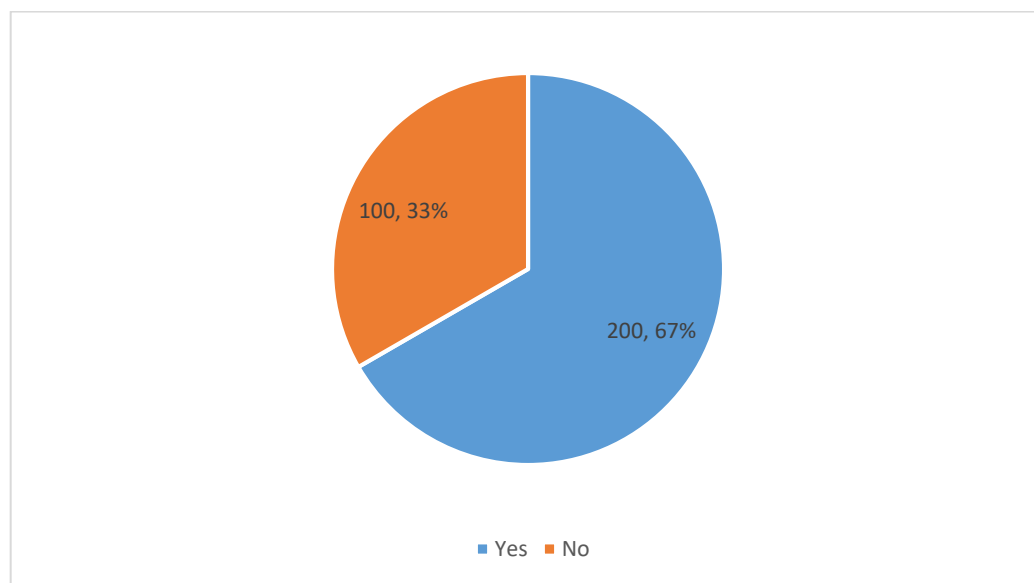
Inference

Majority 37% of the respondent empties waste once a day.

TABLE NO 13: Have you ever been educated on proper waste disposal by council?

	NO OF RESPONDENTS	PERCENTAGE
Yes	200	67%
No	100	33%
Total	300	100%

CHART NO 13: Have you ever been educated on proper waste disposal by council?



Interpretation

It is interpreted that 67% of the respondents says yes and 33% of the respondents says no.

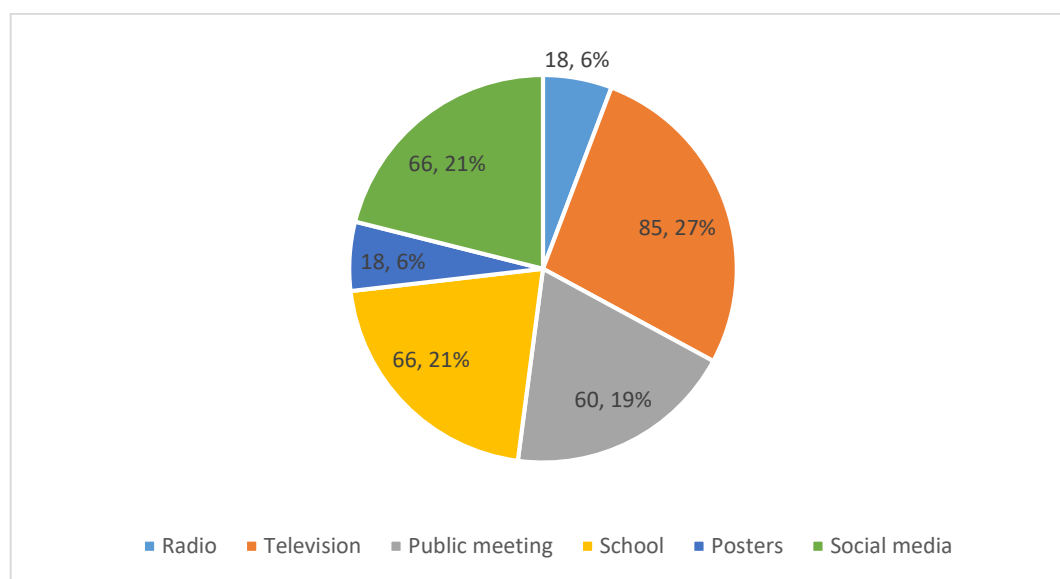
Inference

Majority 67% of the respondents says yes.

TABLE NO 14: In either of the way have you heard of waste management?

	NO OF RESPONDENTS	PERCENTAGE
Radio	18	6%
Television	85	27%
Public Meeting	60	19%
School	66	21%
Posters	18	6%
Social media	66	21%
Total	300	100%

CHART NO 14: In either of the way have you heard of waste management?



Interpretation

It is interpreted that 27% of the respondents says television, 21% says school, 21% says social media, 19% says public meeting, 6% says poster and remaining 6% says radio.

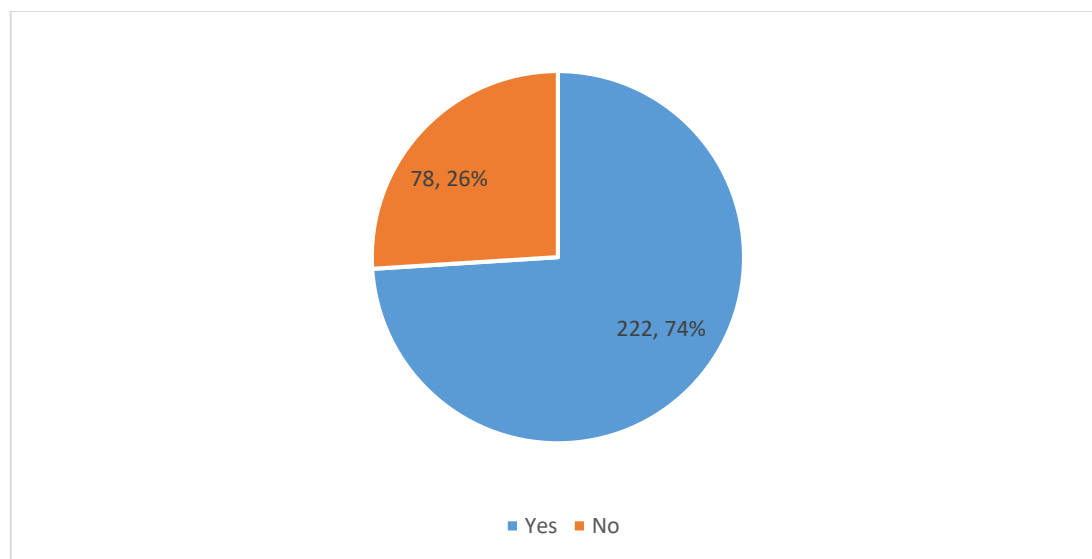
Inference

Majority 27% of the respondents says television.

TABLE NO 15: Do you think the waste disposal method is a problem in your neighborhood?

	NO OF RESPONDENTS	PERCENTAGE
Yes	222	74%
No	78	26%
Total	300	100%

CHART NO 15: Do you think the waste disposal method is a problem in your neighborhood?



Interpretation

It is interpreted that 74% of the respondents says yes and 26% says no.

Inference

Majority 74% of the respondents say yes.

TEST: ONE-WAY ANOVA

The One-way analysis of variance is used to determine whether there are any statistically significant differences between the means of two or more independent groups.

Anova: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
18-24	2	120.4	60.2	7152.08		
25-34	2	88.29	44.1465	3846.25		
35-44	2	56.18	28.0935	1557.54		
45 and above	2	36.12	18.06	643.687		
Total	2	301	150.5	44700.5		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	22436.8	4	5609.20	0.48438	0.74886	5.19216
Within Groups	57900.0	5	11580.0			
Total	80336.9	9				

INTERPRETATION

- ✓ If $F > F_{crit}$, we reject the null hypothesis.
- ✓ Here, $0.48438(F) < 5.19216(F_{crit})$.
- ✓ Therefore, we accept the null hypothesis.
- ✓ The means of the three-age category are equal. At least one of the means is different.

TEST: T-TEST

A t-test is a type of inferential statistic used to determine if there is significant difference between the means of the two groups, which may be related in certain features.

t-Test: Paired Two Sample for Means		
	<i>NO OF RESPONDENT S</i>	<i>PERCENTAG E</i>
Mean	150	0.5
Variance	11688	0.129867
Observations	4	4
Pearson Correlation	1	
Hypothesized Mean Difference	1	
df	3	
t Stat	2.756363017	
P(T<=t) one-tail	0.035183083	
t Critical one-tail	2.353363435	
P(T<=t) two-tail	0.070366165	
t Critical two-tail	3.182446305	

INTERPRETATION

- ✓ If $t \text{ Stat} < -t \text{ Critical two-tail}$ or $t \text{ Stat} > t \text{ Critical two tail}$, we reject the null hypothesis.
- ✓ Here, $-3.182 < 2.756 < 3.182$. Therefore, null hypothesis is rejected.
- ✓ The observed difference between the sample means is convincing enough to say that the average number of what to do with the leftovers of the food between employed and unemployed.

TEST: F TEST

The F- Test two sample for variances tool tests the null hypothesis that two samples come from two independent populations having the equal variances.

F-Test Two-Sample for Variances		
	<i>NO OF RESPONDENTS</i>	<i>PERCENTAGE</i>
Mean	100	0.3335
Variance	12556.8	0.139411
Observations	6	6
df	5	5
F	90070.56	
P(F<=f) one-tail	2.23E-12	
F Critical one-tail	5.050329	

INTERPRETATION

- ✓ If $F > F \text{ Critical one - tail}$, we reject the null hypothesis.
- ✓ Here, $9007 > 5.05$.
- ✓ Therefore, we reject the null hypothesis.

Environmental dimension

Environmental impacts or savings arising from the implementation of a food waste prevention measure can be calculated using a life cycle assessment (LCA) approach. As food waste is being prevented, the embodied impacts associated with the food that is now no longer being wasted are avoided. These include all the impacts generated along the different stages of a product's life cycle. The further along the chain food is wasted, the higher its associated embodied impacts as these accumulate along the chain.

The prevention of food waste further means that the end-of-life stage is being eliminated. The associated avoided disposal impact hereby depends on the formerly chosen waste management option. These avoided impacts relate to both the waste collection as well as the waste treatment. The avoided disposal impacts would need to be complemented with other impacts related to what happens with food leaving the food chain. These measures are however out of scope of this paper. Both the avoided embodied impacts as well as the avoided disposal impacts directly refer to the amount of food waste that is prevented or reduced. An additional source of environmental impacts relates to the implementation of the measure itself. This could refer to changes in logistics or transport (related to for example food redistribution to charities), changes in electricity or water usage, changes in use of packaging or additional use of paper for leaflets and brochures.

Economic dimension

In line with the approach taken in the environmental dimension, food waste prevention measures need to be assessed based on the avoided economic embodied costs, the avoided disposal costs and the implementation costs or savings.

The avoided economic value or embodied cost of food can be determined using the commodity price of a product. Commodity or market prices incorporate the (overhead) costs borne by several actors along the food chain up until the moment of sale, complemented with a certain percentage of profit gain (mark-up) between each of the actors along the chain.

In the case of Restaurants for example, menu prices are based on the procurement price of each ingredient complemented with operational costs (such as energy and water use, waste management, and cleaning) and personnel costs for preparing and cooking the food. Along the same lines, retail prices incorporate operational and personnel costs borne by a supermarket.

As each stage adds up to the cost of food, commodity prices go up as the product moves further along the food supply chain with lowest prices at grower level and highest prices at the end of the supply chain. Both menu prices and retail prices however also include a mark-up charged by the restaurant or seller in order to make profit. As a result, using menu and retail prices to estimate the value of food gone wasted, leads to an overestimation of its value.

The avoided costs for food waste disposal include costs for waste sorting (such as removing bad and spoiled produce in supermarkets), waste collection and treatment, as well as all related administrative costs.

Another approach to calculate the costs associated with the food that is no longer being wasted (and its avoided disposal), is the Life Cycle Costing (LCC) approach which takes into account all costs associated with a product or service over its entire life cycle. Next to the obvious costs related to raw materials acquisition, manufacturing and distribution, LCC considers operating and labor costs, research expenditures and waste collection and disposal costs as well, thereby also including foreseeable costs in the future. This approach is particularly important measures to fully account for by-products such as animal feed, compost, and electricity.

The third cost item refers to the implementation costs and savings associated with the food waste measure itself, covering both fixed and variable costs. Fixed costs for example include investments in new technologies or materials, investments in new logistics, expenses for printing leaflets and brochures at the start of a campaign, or expenses for personnel training. Variable costs or savings on the other hand refer to changes in daily or continuous activities such as time spent for food production, time spent for waste administration, personnel hours, daily campaign costs, or changes in electricity and water usage.

Social dimension

Next to the environmental and economic effects, there may also be social effects. Redistribution of food waste to food charities for example results in a number of meals given to people. As such, the number of meals saved and subsequently donated can serve as a social indicator.

Another indicator relates to the opportunities for job creation brought about by food waste measures. New jobs may be created in the life cycle stage where food waste is being prevented, as well as in other sectors or stages along the food chain where the food is being reused, recovered, or recycled, such as in food charities or food recycling.

CHAPTER – 5

FINDINGS, SUGGESTIONS AND CONCLUSIONS

5.1 FINDINGS OF THE STUDY

- Majority 40% of the respondents are 18 to 24.
- Majority 55% of the respondents are female.
- Majority 46% of respondents are higher secondary.
- Majority 44% of the respondents are employed.
- Majority 37% of the respondents makes several purchases in a week.
- Majority 43% of the respondents are feeding animals.
- Majority 73% of the respondents says knows that we can convert wastes into usable products.
- Majority 43% of the respondents rates 3 in wasting their food.
- Majority 38% of the respondents choose bought/cooked too much.
- Majority 29% of the respondents uses carton.
- Majority 27% of the respondents says television creates awareness about waste management.
- Majority 74% of the respondents says waste disposal is the problem in the neighborhood.
- Majority 37% of the respondent empties waste once a day.

5.2 SUGGESTIONS OF THE STUDY

- Waste management must involve waste segregation to allow more efficient value in recycling.
- Efforts to improve waste storage and collection are required.
- Involvement of self-help groups, youth groups and small entrepreneurs.
- Well-planned and effective training policy in waste management.
- The adoption and transfer of the technologies from the developed countries.

5.3 CONCLUSION OF THE STUDY

The last few years, a lot of measures addressing food waste have been proposed and implemented. Recent literature reviews call for more evidence on the effectiveness or food waste reduction potential of these measures. Furthermore, very few information is available on the extent to which food waste measures have been evaluated based on their economic, environmental and social performance. This review closes this knowledge gap by looking at the methodologies currently used in literature to evaluate food waste prevention measures, using a pre-defined assessment framework with quantitative evaluation criteria.

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HOUSEHOLD WASTE MANAGEMENT

This survey is taken to analyze the household food waste . Please make sure to answer the questions as honest as possible and click the best fitting option.

1. Name *

2. Age *

Mark only one oval.

- ☐ 10 to 16
- ☐ 17 to 24
- ☐ 25 to 30
- ☐ 31 and above

3. Gender *

Mark only one oval.

- ☐ Male
- ☐ Female
- ☐ Prefer not to say

4. Religion *

Mark only one oval.

- ☐ Hindu
- ☐ Christian
- ☐ Muslim
- ☐ Prefer not to say

5. Educational Qualification *

Mark only one oval.

- ☐ Higher Secondary
- ☐ Undergraduate
- ☐ Postgraduate
- ☐ Diploma
- ☐ Others

6. Occupation *

Mark only one oval.

- ☐ Superior
- ☐ Manager
- ☐ Other: _____

7. Employment Status *

Mark only one oval.

- ☐ Employed
- ☐ Unemployed
- ☐ Self employed

8. Number of dependents in the family *

Mark only one oval.

- ☐ 2
- ☐ 2 - 4
- ☐ More than 4

FINANCE ASSETS

9. Source of income *

Mark only one oval.

- ☐ Business
- ☐ Job
- ☐ Rental Income
- ☐ Capital assets

10. Number of earning members *

Mark only one oval.

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ More than 3

11. Monthly Income *

Mark only one oval.

- ☐ Rs 10000
- ☐ Rs 10000 to Rs 25000
- ☐ Rs 25000 to Rs 50000
- ☐ Above than 50000

12. Monthly expenditure *

Mark only one oval.

- ☐ 20 % of income
- ☐ 20 - 40 % of income
- ☐ 40 - 60 % of income
- ☐ More than 60 % of income

13. Monthly Savings *

Mark only one oval.

- ☐ 0% - 20%
- ☐ 20% - 40%
- ☐ 40% - 60%
- ☐ Above 60%

14. Have you taken any loans mentioned below? *

Mark only one oval.

- ☐ Personal loan
- ☐ Bank loan
- ☐ Tenant loan
- ☐ Loan from Private Institution
- ☐ Loan from Broker
- ☐ None

PHYSICAL ASSETS

15. Do you have well furnished hospital facilities in your area? *

Mark only one oval.

- ☐ Yes
- ☐ No

16. Do you have market facilities in your area? *

Mark only one oval.

☐ Yes

☐ No

17. Do you have bank facilities for proper transactions ? *

Mark only one oval.

☐ Yes

☐ No

18. What kind of government office available in your area? *

Mark only one oval.

☐ Corporation office

☐ Tahsildar office

☐ Register office

☐ Collector office

☐ None

19. Do you have well furnished educational institution like schools, colleges in your area? *

Mark only one oval.

☐ Yes

☐ No

NATURAL CAPITAL

20. Give a opinion about ground water level in your area. *

Mark only one oval.

- ☐ Adequate ground water level
- ☐ Under ground water level

21. How many percentage of land occupied buildings ? *

Mark only one oval.

- ☐ No empty lands
- ☐ 50% occupied building
- ☐ 50 to 80% occupied building
- ☐ More than 80% occupied building

22. Is there any windmills ? *

Mark only one oval.

- ☐ Yes
- ☐ No

23. Is there any freshwater source in your area? *

Mark only one oval.

- ☐ Yes
- ☐ No

24. Are you engaged in any social activities? *

Mark only one oval.

- ☐ NGO
- ☐ Lion's Club
- ☐ Self help group
- ☐ Voluntary activities
- ☐ None

25. Which circle you will be interacting more? *

Mark only one oval.

- ☐ Friend circle
- ☐ Family circle
- ☐ Office circle
- ☐ Neighbor circle

26. Which way did you interact with people more ? *

Mark only one oval.

- ☐ Face to face
- ☐ Social media

27. Which social media platform do you have more contacts ? *

Mark only one oval.

☐ Whatsapp

☐ Facebook

☐ Instagram

☐ Twitter

☐ Telegram

HOUSEHOLD FOOD WASTE



28. How do you purchase your everyday commodities ? *

Mark only one oval.

- ☐ Several purchases in a week
- ☐ Look around and decide a lot based on price/kg
- ☐ One big weekly shopping occasion
- ☐ Daily basis

29. Do you throw away your food? *

Mark only one oval.

- ☐ Yes
- ☐ No
- ☐ Sometimes

30. What do you do with the leftovers of your food? *

Mark only one oval.

- ☐ Giving it for charity
- ☐ Feeding animals
- ☐ Throw it away
- ☐ Other: _____

31. Do you know that we can transform food waste into usable products? *

Mark only one oval.

- ☐ Yes
- ☐ No

32. How often do you throw away leftovers? *

Mark only one oval.

	1	2	3	4	5	
Very often	☐	☐	☐	☐	☐	Never

33. Why do you waste food ? *

Tick all that apply.

- ☐ Bought/cooked too much
- ☐ Expiry date
- ☐ Went bad
- ☐ Other

34. What are the reasons there are leftovers on your plate today ? *

Tick all that apply.

- ☐ Was in a rush
- ☐ I am a picky eater
- ☐ The food was cold
- ☐ Didn't like the cooking method
- ☐ The portion size given is too big

35. How do you feel when throwing away food ? (Give an answer for each emotion) (5 is high) *

Mark only one oval per row.

	1	2	3	4	5
Ashamed	☐	☐	☐	☐	☐
Guilty	☐	☐	☐	☐	☐
Sad	☐	☐	☐	☐	☐
Indifferent	☐	☐	☐	☐	☐
Care free	☐	☐	☐	☐	☐

36. In what type of container do you collect waste food ? *

Mark only one oval.

- ☐ Carton
- ☐ Waste Basket
- ☐ Old bucket
- ☐ Plastic bag
- ☐ Tin

37. How often is the waste container emptied ? *

Mark only one oval.

- ☐ Once a day
- ☐ Once in three days
- ☐ Once a week
- ☐ Other

38. Have you ever been educated on proper waste disposal by council ? *

Mark only one oval.

☐ Yes

☐ No

39. In either of the way, Have you heard of waste management ? *

Mark only one oval.

☐ Radio

☐ Television

☐ Public Meeting

☐ School

☐ Posters

☐ Other: _____

40. Have you ever tried to reduce the leftovers ? *

Mark only one oval.

	1	2	3	4	5	
Not at all	☐	☐	☐	☐	☐	Totally

41. Do you think the waste disposal method is a problem in your neighborhood ? *

Mark only one oval.

☐ Yes

☐ No

42. How do you rate your knowledge about waste management ? *

Mark only one oval.

1 2 3 4 5

Low ☐ ☐ ☐ ☐ ☐ High

ANNEXURE – 2

Sustainable development: A case study
on household food waste management

Ms.K.SELVA PRIYA. B.Com, MBA. ,

School of Management Studies,

Sathyabama

Institute of Science and Technology

Chennai, Tamilnadu, South India

novempriya@gmail.com

Dr.G.Bhuvaneswari. MBA., M.com.

M.Phil.,

Ph.D.,

Assistant Professor, Sathyabama

Institute of

Science and Technology

Chennai, Tamilnadu, South India.

ABSTRACT

Proper food waste management is a fundamental key to environmental sustainability. In recent years, food waste has received growing interest from rural and urban areas, NGO'S as well as international organizations from various disciplinary fields. Increasing concerns about food security and environmental impacts, such as resource depletion and greenhouse gas emissions attributed to food waste, have intensified attention to this research. While food waste occurs in all stages of the food supply chain, households have identified as key actors in food waste generation. This paper briefs the still small but expanding academic territory of consumer food waste by reviewing studies and the answers of the people on food waste management and impede the generation of food waste on the household level. This research briefly analyses the food waste in household and their sustainability factors. Keywords: Sustainability, households, urban areas, generation.

I.INTRODUCTION

Food waste at the household level represents a major component of all food waste. Therefore, minimizing food waste at the household level remains an important component of the food chain responsibility. This study explores the problem of food waste. This includes the generation of food waste on the household and waste disposals in villages.

Sustainable waste management refers to the collection, transportation, valorization and disposal of the various types of waste, in a manner that does not jeopardize the environment, human health or future generations. It includes any activity involved in the organization of waste management, from production to the final treatment. It is important to note that there are various types of wastes, such as municipal, which includes household, commercial and demolition waste; electronic or e-waste, which includes computer parts; and radioactive waste, among many other forms of waste.

The goal of sustainable waste management is to reduce the amounts of natural resources consumed, reusing the material taken from nature as much as it is possible, and creating as minimal waste as possible. It is our responsibility to maintain sustainability for the benefit of our environment as well as future generations. A well-functioning sustainable waste management system, focus on processes, embody adaptability and divert wastes from the disposal. Sustainable waste management is a key concept of the circular economy and offers many opportunities and benefits to both the economy, the society and the environmental.

II.OBJECTIVES OF THE STUDY

- To understand the importance of household food waste management.
- To assess the quantity of food waste generated in households.
- To recycle the waste after to the extent possible.
- To analyze their disposal methods.

III.REVIEW OF LITERATURE

- John Paul Castillo Vallente, Mark Raguindin Limon and Neil Christian T. Corales (2020) Solid waste management beliefs and practices in rural households towards sustainable development. This study examined the waste management beliefs and practices of rural households when it comes to solid waste management. It was also found that minimal effort is done in reusing and recycling of waste materials among households.
- Davide Tonini (2020), Quantitative sustainability assessment of household food waste management in the Amsterdam Metropolitan Area, This study quantifies the sustainability of the status quo and five alternative household food waste management scenarios for the case of the Amsterdam Metropolitan Area.
- (Aye & Widjaya, 2006), the management of waste become complex and the facilities provided cannot cope with the increasing demand and needs. Therefore, best approach need to be implemented immediately while considering environmental, social and economic aspect .The drivers of sustainable waste management were clarified by Agamuthu et al. (2009), which include human, economic, institutional and environment aspect. The study suggests that each driving group should be considered in local context as managing solid waste for a

particular society may differ from the others.

- (Couth & Trois, 2010), waste managers in Africa need to tackle some issues including, lack of data, insignificant financial resources, vast different of amount and waste types between urban and rural area, lack of technical and human resources, low level of awareness and cultural aversion towards waste .On the other hand, problems faced among Asian countries differ with two distinct groups; developed and developing countries. While some of the countries are having specific national policy on solid waste management, some others experience problems such as increasing urban population, scarcity of land, services coverage area, inadequate resources and technology, and so on (Shekdar, 2009).
- (Berkun et al., 2005), the differences in managing solid waste not only vary between countries but also among areas in the same country. For instance, while Istanbul are having big improvement in their solid waste management with the establishment of transfer stations, sanitary landfills and methane recovery system, it does not reduce the problem in the Black Sea coast in Turkey. This is caused by the complex topography, weak administrative structures and the low local's income.
- (Van de Klundert, 1999) Integrated Sustainable Waste Management (ISWM) system was then introduced in 1995 to improve earlier system that neglect unique characteristics of a given society, economy and environment. For example, European countries had applied various system assessment tools and engineering models to create sustainable communities, manage

resources efficiently, tapping innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion in their SWM system (Pires et al., 2011). Asian countries had also given attention in building the national legal frameworks, managing institutional, technology, operational and financial aspects, and creating public awareness and participation.

- (Kathiravale & Mohd Yunus, 2008) Developed countries generate more waste than developing countries. Countries in Asian and African region produce waste in the range of 0.21-0.37 tons/ capita/ year, while European countries generate higher amount of waste with 0.38-0.64 tons/ capita/ year (Intergovernmental Panel on Climate Change [IPCC], 2006).
- (Idris et al., 2004) The generation of waste is also reported to be associated with the economic status of a country. In Asia, countries with higher GDP, namely Hong Kong and Japan were reported to generate more waste compared to developing countries such as India, Vietnam and Nepal (Shekdar, 2009). Waste composition from these countries also differs where rural areas often produce more organic waste and fewer recyclable items.

IV. RESEARCH METHODOLOGY

RESEARCH DESIGN

- Research design refers to the framework of market research methods and techniques that chosen by a researcher.
- The design that chosen by the researchers allow them to utilize the methods that are suitable for the study and to set up their studies successfully in the future as well.

DESCRIPTIVE RESEARCH DESIGN

Descriptive research is a study designed to depict the participants in an accurate way. More simply put, descriptive research is all about describing people who take part in the study.

V. DATA COLLECTION SOURCES OF DATA

Data collection is the term used to describe a process of preparing and collecting data.

- Primary Data – Questionnaire prepared using Google forms, which responded by 300 respondents.
- Secondary Data - Websites and online journals, Published reports & Review of literature from published articles.

STRUCTURE OF QUESTIONNAIRE

Questionnaire divided into six sections.

- First section – Basic Information.
- Second section – Finance capital.
- Third section – Physical capital.
- Fourth section – Natural capital.
- Fifth section - Social capital.
- Sixth section – Respondents awareness, opinion and suggestion about household waste management.

SAMPLING TECHNIQUE

Convenience sampling method
A convenience sample is one of the main types of non-probability sampling methods. A convenience sample is made of people who are easy to reach.

PERIOD OF STUDY

The Research done to learn about the sustainability factors in household food waste management for about three months.

VI. ANALYTICAL TOOLS

TEST: ONE-WAY ANOVA

The One-way analysis of variance is used to determine whether there are any statistically significant differences between the means of two or more independent groups.

Anova: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
18-24	2	120.4	60.2	7152.08		
25-34	2	88.29	44.1465	3846.25		
35-44	2	56.18	28.0935	1557.54		
45 and above	2	36.12	18.06	643.687		
Total	2	301	150.5	44700.5		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	22436.8	2	5609.20	0.48438	0.74886	5.19216
Within Groups	57900.0	7	11580.0			
Total	80336.9	9				

INTERPRETATION

- ☐ If $F > F_{crit}$, we reject the null hypothesis.
- ☐ Here, $0.48438(F) < 5.19216(F_{crit})$.
- ☐ Therefore, we accept the null hypothesis.
- ☐ The means of the three-age category are equal. At least one of the means is different.

TEST: T-TEST

A t-test is a type of inferential statistic used to determine if there is significant difference between the means of the two groups, which may be related in certain features.

t-Test: Paired Two Sample for Means		
	NO OF RESPONDENTS	PERCENTAGE
Mean	150	0.5
Variance	11688	0.129867
Observations	4	4
Pearson Correlation	1	
Hypothesized Mean Difference	1	
df	3	
t Stat	2.756363017	
P(T<=t) one-tail	0.035183083	
t Critical one-tail	2.353363435	
P(T<=t) two-tail	0.070366165	
t Critical two-tail	3.182446305	

INTERPRETATION

- ☐ If $t_{Stat} < -t_{Critical \text{ two-tail}}$ or $t_{Stat} > t_{Critical \text{ two-tail}}$, we reject the null hypothesis.
- ☐ Here, $-3.182 < 2.756 < 3.182$. Therefore, null hypothesis is rejected.
- ☐ The observed difference between the sample means is convincing enough to say that the average number of what to do with the leftovers of the food between employed and unemployed.

TEST: F TEST

The F- Test two sample for variances tool tests the null hypothesis that two samples come from two independent populations having the equal variances.

F-Test Two-Sample for Variances		
	NO OF RESPONDENTS	PERCENTAGE
Mean	100	0.3335
Variance	12556.8	0.139411
Observations	6	6
df	5	5
F	90070.56	
P(F<=f) one-tail	2.23E-12	
F Critical one-tail	5.050329	

INTERPRETATION

- If $F > F_{\text{Critical one-tail}}$, we reject the null hypothesis.
- Here, $9007 > 5.05$.
- Therefore, we reject the null hypothesis.

Environmental dimension

Environmental impacts or savings arising from the implementation of a food waste prevention measure can be calculated using a life cycle assessment (LCA) approach. As food waste is being prevented, the embodied impacts associated with the food that is now no longer being wasted are avoided. These include all the impacts generated along the different stages of a product's life cycle. The further along the chain food is wasted, the higher its associated embodied impacts as these accumulate along the chain.

The prevention of food waste further means that the end-of-life stage is being eliminated. The associated avoided disposal impact hereby depends on the formerly chosen waste management option. These avoided impacts relate to both the waste collection as well as the waste treatment.

The avoided disposal impacts would need to be complemented with other impacts related to what happens with food leaving the food chain. These measures are however out of scope of this paper.

Both the avoided embodied impacts as well as the avoided disposal impacts directly refer to the amount of food waste that is prevented or reduced. An additional source of environmental impacts relates to the implementation of the measure itself. This could refer to changes in logistics or transport (related to for example food redistribution to charities), changes in electricity or water usage, changes in use of packaging or additional use of paper for leaflets and brochures.

Economic dimension

In line with the approach taken in the environmental dimension, food waste prevention measures need to be assessed based on the avoided economic embodied costs, the avoided disposal costs and the implementation costs or savings.

The avoided economic value or embodied cost of food can be determined using the commodity price of a product. Commodity or market prices incorporate the (overhead) costs borne by several actors along the food chain up until the moment of sale, complemented with a certain percentage of profit gain (mark-up) between each of the actors along the chain. In the case of restaurants for example, menu prices are based on the procurement price of each ingredient complemented with operational costs (such as energy and water use, waste management, and cleaning) and personnel costs for preparing and cooking the food. Along the same lines, retail prices incorporate operational and personnel costs borne by a supermarket. As each stage adds up to the cost of food, commodity prices go up as the product moves further along the food supply chain with lowest prices at grower level and highest prices at the end of the supply chain. Both menu prices and retail prices however also include a mark-up charged by the restaurant or seller in order to make profit. As a result, using menu and retail prices to estimate the value of food gone wasted, leads to an overestimation of its value.

The avoided costs for food waste disposal include costs for waste sorting (such as removing bad and spoiled produce in supermarkets), waste collection and treatment, as well as all related administrative costs.

Another approach to calculate the costs associated with the food that is no longer being wasted (and its avoided

disposal), is the Life Cycle Costing (LCC) approach, which takes into account all costs, associated with a product or service over its entire life cycle. Next to the obvious costs related to raw materials acquisition, manufacturing and distribution, LCC considers operating and labor costs, research expenditures and waste collection and disposal costs as well, thereby also including foreseeable costs in the future. This approach is particularly important measures to fully account for by-products such as animal feed, compost, and electricity. The third cost item refers to the implementation costs and savings associated with the food waste measure itself, covering both fixed and variable costs. Fixed costs for example include investments in new technologies or materials, investments in new logistics, expenses for printing leaflets and brochures at the start of a campaign, or expenses for personnel training. Variable costs or savings on the other hand refer to changes in daily or continuous activities such as time spent for food production, time spent for waste administration, personnel hours, daily campaign costs, or changes in electricity and water usage.

Social dimension

Next to the environmental and economic effects, there may also be social effects. Redistribution of food waste to food charities for example results in a number of meals given to people. As such, the number of meals saved and subsequently donated can serve as a social indicator. Another indicator relates to the opportunities for job creation brought about by food waste measures. New jobs may be created in the life cycle stage where food waste is being

prevented, as well as in other sectors or stages along the food chain where the food is being reused, recovered, or recycled, such as in food charities or food recycling.

VII.FINDINGS OF THE STUDY

Majority 40% of the respondents are 18 to 24. Majority 55% of the respondents are female. Majority 46% of respondents are higher secondary. Majority 44% of the respondents are employed. Majority 37% of the respondents makes several purchases in a week. Majority 43% of the respondents are feeding animals. Majority 73% of the respondents says knows that we can convert wastes into usable products. Majority 43% of the respondents rates 3 in wasting their food. Majority 38% of the respondents choose bought/cooked too much. Majority 29% of the respondents uses carton. Majority 27% of the respondents says television creates awareness about waste management. Majority 74% of the respondents says waste disposal is the problem in the neighborhood. Majority 37% of the respondent empties waste once a day.

VIII. SUGGESTIONS OF THE STUDY

- Waste management must involve waste segregation to allow more efficient value in recycling.
- Efforts to improve waste storage and collection are required.
- Involvement of self-help groups, youth groups and small entrepreneurs.
- Well-planned and effective training policy in waste management.
- The adoption and transfer of the technologies from the developed countries.

IX CONCLUSION OF THE STUDY

The last few years, a lot of measures addressing food waste have been proposed and implemented. Recent literature reviews call for more evidence on the effectiveness or food waste reduction potential of these measures. Furthermore, very few information is available on the extent to which food waste measures have been evaluated based on their economic, environmental and social performance. This review closes this knowledge gap by looking at the methodologies currently used in literature to evaluate food waste prevention measures, using a pre-defined assessment framework with quantitative evaluation criteria.

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