Study of Potential Food Waste in Zero Waste Cities Area-Saridewi, Denpasar-Bali

I Nengah Muliarta[1,3*], Catur Yudha Hariani[2], Ni Made Indra Wahyuni[2], A.A Tatik Rismayanti[2]

[1] Agrotechnology Study Program, Faculty of Agriculture, Warmadewa University, Denpasar-Indonesia
[2] Environmental Education Centerm, Denpasar-Indonesia.
[3] Master of Agricultural Science, Warmadewa University, Indonesia.

Abstract: Food waste affects food security, the environment, and the economy in practically every country. The amount of food that is thrown away should be enough to feed the world's hungry people. Denpasar, as a large city with a growing population and a growing number of tourists, has food waste management issues. Unfortunately, no research has been done in the Denpasar City region on the possibility of food waste. This study aims to look at the possibilities of food waste in Denpasar's Saridewi area. The goal is to calculate the quantity of food wasted in communities that have implemented the zero-waste city concept for a year. The survey and observation methods were applied in this research. The survey was carried out by distributing a questionnaire, and observations were taken by weighing the food waste generated by households in the Saridewi suburb. The findings reveal that Saridewi inhabitants have adopted the zero-waste concept in food waste management, converting food waste into compost, animal feed, and others. One of the factors contributing to the generation of food waste in Saridewi is the practice of buying food ingredients and raring food without planning. On average, Saridewi residents produce food waste of 0.14 kg/person/day.

Keywords: Food waste; Management; Potential waste; Saridewi; Zero waste

Introduction

Food waste refers to food that is safe for human consumption but is abandoned, wasted, amaged, or fed by animals, as well as pieces that are not consumed (Bond et al., 2013). Food waste is becoming a problem in a number of countries as a result of its numerous consequences. Food waste has an impact on food security, the environment, and the economy, according to (Abiad & Meho, 2018). Along the food supply chain from production to consumption, up to 1.3 billion tonnes of edible food (one-third of global food output) is wasted (Gustavsson et al., 2013). The amount of food wasted could feed one-eighth of the world's population, who suffers from nutritional and food insecurity.

Food waste disposal is the same as wasting resources. Food waste has a negative impact on the economy because it wastes resources that would

otherwise be utilized to manufacture food, such as food raw materials, water, and energy (FAO, 2017). According to Gustavsson et al., (2013), 33.33% of the world's food is lost each year, equating to 1.3 trillion tons of food. This remark makes it increasingly difficult for the government to meet rising food demand as the population grows. This has a significant effect on food security. Food security is one of the sustainability criteria which has become a human right. Food security is defined in Law No. 18 of 2012 as the food availability for the state to persons in sufficient numbers and of good quality, that is safe and nutritious, but that should not violate religious rules, customs, and culture.

Food waste occurs as a result of meals that are not consumed. Breakfast, lunch, and dinner all generate waste. Due to a rush to get to school or work, they don't even have time to eat their rice for breakfast (Mulyo, 2016). This habit is also observed in households where

the employees are self-employed. Food waste has a significant influence on economic losses in addition to lowering food security. Every gram of rice thrown away is equivalent to throwing away money. Livelihood routines will be interrupted and a crisis will arise in households if income is reduced or mismanaged, especially in urban communities in industrial districts.

Indonesian food waste management, particularly in relation to the 3R program, has not been done in a controlled way. Because the accumulation of food waste in landfills has the potential to produce methane gas, which is detrimental to the ozone layer and causes global warming, its management necessitates community participation (Rachman & Septiana, 2020). Methane gas emissions have a 21-fold larger global warming potential than carbon dioxide emissions (Rini et al., 2020). Food waste in restaurants own can exceed 2 liters per person per day (Brigita & Rahardyan, 2013). During religious festivals, such as the month of fasting, the number will rise (Muhtarom, 2016). One of the food wastes, particularly leftovers that are no longer fit for human consumption,can be utilized as animal feed (Truong et al., 2019).

Food waste management is one approach to put the zero-waste concept into practice at home. According to Murray & Greenpeace., (2002), the zero waste system comprises the waste producer's responsibilities in an endeavor to decrease waste, reuse, and recycle. In order to attain zero waste,an integrated waste management program is required, which includes everything from trash minimization through recycling and composting.

Bali, which is among the world's tourist destinations with a population of 3.9 million and tourist visits of more than two million people every year, faces difficulty with waste managementthat is not yet optimal (Zurbrügg et al., 2012). Suwung landfill is one of the largest landfills in the world. Organic waste amounts to 78.1% of total waste in the Suwung landfill, while inorganic waste amounts to21.9%. Garden waste amounts to 45.71 % of organic waste, while food waste amounts to 17.71 % (Dewi et al., 2017). The issue is that there has been no research on the potential for household food waste in Bali until now. This study is necessary in order to developa management plan that can be used effectively and can be used to execute the zero waste conceptat the household level.

Method

The food waste study was carried out in the Saredawi area, Jalan Nangka Utara, Tonja Village, Denpasar, and other supporting data were obtained from 10 garbage shelters throughout Denpasar City. The Saridewi area was chosen because residents in the area have implemented the concept of zero waste since early 2020. The data collection time in Saridewi starts from January 20 – February 13, 2021, while data collection to temporary shelters starts the fourth week of April – Sunday of May 2021. The polling stations that were surveyed are as follows: the North Denpasar District area covering Lumintang and Mount Agung, the West Denpasar District area covering Monang Maning, Level XXI, and Dauh Puri, the East Denpasar District area covering Yangbatu, Kreneng, and Kertalangu Kesiman, the South Denpasar District area covering Sidakarya and Sesetan.

Communities in the Saridewi area of Tonja Village, Denpasar, were the study's focus, with a total of 89 KK distributed to the study. Only 62 families were sampled in required to conduct the waste weighing activity (219 people). Questionnaires were distributed in the Saridewi area to research participants. Communities of Saridewi were given a questionnaire to fill out about their current consumption habits, as well as the amount of food waste they produce and how it is processed. Weighing of organic waste (garden organic waste and kitchen organic waste or food waste), as well as residue. From January 20 to February 13, 2021, the surveyors weight the waste around 8 times before transporting them by waste collectors on Wednesdays and Saturdays.

The questionnaire and data were descriptively and quantitatively examined. Descriptive analysis aims to describe systematically a characteristic or subject under study. While quantitativeanalysis is a description of the numerical value obtained by the subject as an answer in the subjectof research.

Result and Discussion

The Characteristics of Respondents

Men account for the majority of responders (57.30%), with a median age of 41-50 years reaching 35.96 percent. Gender and age are assumed to have an impact on the amount of foodwaste that can be generated in a selected area. Women have an important part in household management, taking care of tasks such as food preparation (Hadiningrat, 2020). Women are incharge of purchasing groceries, storing them, preparing them, and lastly disposing of them (Cequea et al., 2021). Indonesia has a dynamic women's group that receives official funding. Women may lower the amount of leftover food produced at home if they were participating in community organizations, according to the findings. They also properly manage their food and waste (Hadiningrat, 2020). Educated women have a better understanding of proper storage. The amount of food wasted is affected by proper storage (Jungowska et al., 2021).

The age factor has a considerable impact on the amount of food waste produced. Whereas food waste decreases as one gets older, it increases as one gets more educated and has a larger family (Marangon et al., 2014). Residents aged 19 to 55 have a big influence on how food waste is separated in their homes. The issue is which family members in this age group are generally too concerned with their jobs to participate in domestic waste management (Bunditsakulchai & Liu, 2021). Apart from age, attitudes and income have a significant impact on food waste management behavior (Marangon et al., 2014).

The majority of the respondents (60.67 %) have completed high school, whereas 14.61 % have only completed basic school and only 5.62 % have completed undergraduate education. The higher a person's education, the more likely they are to recycle their waste. Consumer behavior in managing food waste will be influenced by information and experience because knowledge has a strong impact on behavior (Jalil et al., 2019). Residents with a greater degree of education are more concerned about social issues and are more likely to recycle (Bunditsakulchai & Liu, 2021). Residents with higher academic credentials, on the other hand, devote a significant amount of time to work (Marangon et al., 2014). Education on how to keep food and make further use of food waste is an important part of reducing food waste (Jungowska et al., 2021).

Private employees contribute for 69.66 % of the respondents' jobs, while housewives' figure for 16.85 %. Monthly income ranges from Rp. 2,000,000 to Rp. 5,000,000 for 65.17 % (Figure 1). This revenue can be used as a baseline for estimating household economic losses. High income is thought to be a motive for customers to buy a variety of foods in large quantities, resulting in increased food waste.

Residents with higher incomes produce more food waste in general, as well as various types of materials. The majority of middle-income consumers waste bread and fresh fruit, which are typically thrown away by wealthier households (Zachár, 2019). When compared to more affluent people, low-income groups produce less food waste. This could be the result of poor storage conditions, such as a lack of refrigeration (World Wide Fund South Africa, 2017). As household incomes improved and food kinds diversified, including perishable fruits, vegetables, and meat, food waste began to rise (Lopez Barrera & Hertel, 2021). Food waste is primarily caused by high-income families cooking excessive portions of food (Ramukhwatho et al., 2016).
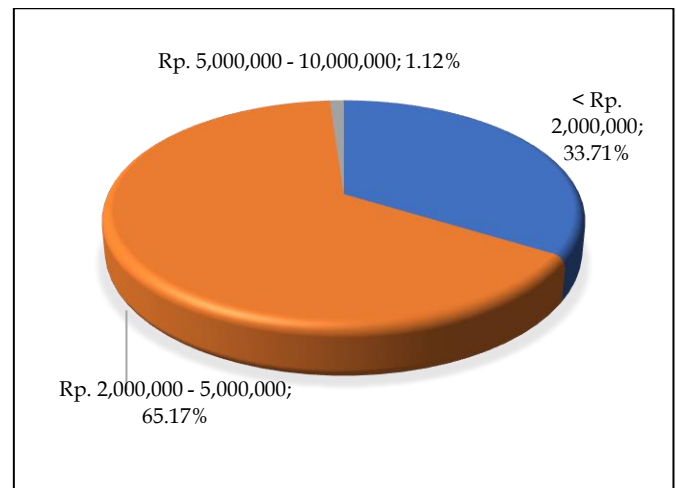

Figure 1. The average Income of Respondents in the Saridewi area, Denpasar

Consumption Habit

Communities of Saridewi buy basic goods and raw vegetables from stalls or marketplaces in 97.75 %. Respondents who choose to buy basic items may shop excessively or not at all in order to meet their demands. As a result, purchasing these materials will be more expensive, resulting in greater economic losses. Consumers with passionate purchasing behavior waste more food, according to Zainal & Hassan (2019). Excessive buying happens as a result of pricing reactions (discount offers and price gradients) (Aschemann-Witzel et al., 2015).

Proper planning of time will help you avoid making impulse purchases, resulting in food shortages waste (Zainal & Hassan, 2019). Although the product being sold has an impact on food purchases (Cequea et al., 2021). Buying too much food is the most common cause of wastage, which is generally caused by receptivity to promotion, eagerness to buy extra stock, and a lack of prior planning (Jungowska et al., 2021).

Food waste is the outcome of a complicated interaction between the activities of food planning, purchasing, storing, preparation, and consumption at the household level (Aschemann-Witzel et al., 2015; Quested & Johnson, 2012). Although post-consumption waste contributes the most in terms of waste volume and environmental impact, other stages of the food supply chain, such as primary production, processing, and distribution, also have a substantial impact (Jeswani et al., 2021). Food loss is defined as a reduction in the quantity or quality of food (FAO, 2017).

Specifically for the satisfaction of cooked food, 79.78 % cook their own meals. It is estimated that 19.10 % buy staple meals and cooked vegetables on a daily basis. For more practical reasons, 91.01 % decided to purchase cooked food (Figure 2). The habit of buying staple foods and cooked vegetables installs a lot of money if done

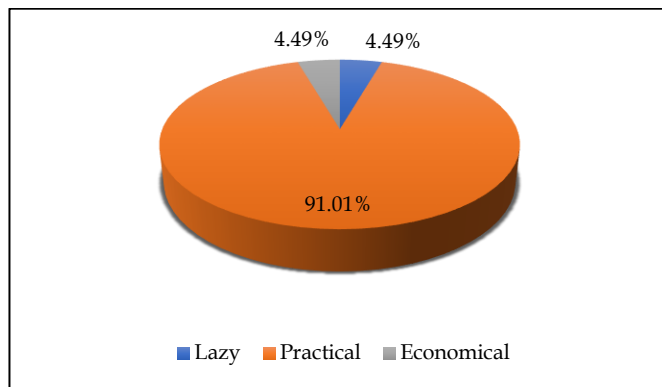every day. This tendency isaggravated by the practice of wasting food.

Figure 2. People Tend to Choose Staple Food for More Practical Reasons.

Due to various diets and dietary habits, food waste can occur across the food supply chain. Another important aspect is the great frequency with which people eat out and consume fast food (Liu et al., 2020). A consumerist culture fueled by relatively low food prices exacerbates this problem (Aschemann-Witzel et al., 2015). The availability of a delivery system also encourages customers to make larger-than-normal purchases (Rachman & Septiana, 2020). It is estimated that the larger the amount of food purchased at one time, the more likely it is that the household will produce more food waste (Kim & Lee, 2020).

Food waste is more widespread among households that shop at supermarkets and hypermarkets (Marangon et al., 2014). Packaging appears to play a role in the production of food waste, particularly when packaging contains more food than is required (Williams & Walton, 2011). Food waste at the household level can be reduced by planning and gathering informationon things to be purchased before going shopping (Marangon et al., 2014). Although the primary reason for wasting food at home is it has passed its "use by" date and is of poor quality,the main reason for wasting food when dining out is that people overorder and portion sizes are excessively high (Liu & Nguyen, 2020).

The amount of food waste created by a family is strongly influenced by the number of meals consumed in a single day. As many as 76.40 % of Saridewi inhabitants eat three to four times every day (Figure 3). The frequency with which people eat has the potential to increasefood waste and thus increase economic losses.
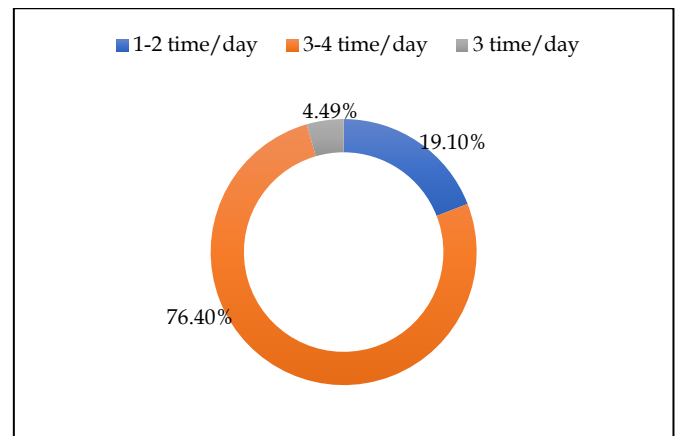

Figure 3. The Trend of Eating Frequency Per Day for Saridewi Residents

The assumption that an increasing amount of eating per day leads to an increase in the volume of waste is supported by data from respondents' responses. It was discovered that 60.67% said they frequently had leftovers from staple foods and veggies. According to research conducted in Europe, eating habits are the primary driver of food waste generation at the household level (Davenport et al., 2019). Residents in rural areas, on average, eat 2.3 timesper day, which is greater than those in urban areas, which eat 1.7 times per day (Liu & Nguyen, 2020). Efforts to reduce food waste while maintaining production levels can contribute to meeting global food demands. Steps taken to prevent food waste in one locationmay result in more food being available in other areas (Thyberg & Tonjes, 2016).

Food Waste Prevention and Management

Research data shows, 70.79 % said they produce less than 100 grams of food waste per familyper day (Figure 4). This demonstrates how much money is lost due to discarded food scraps. If theprice of the main food in every 100 grams is known, the amount of loss will be extremely easy tocompute.
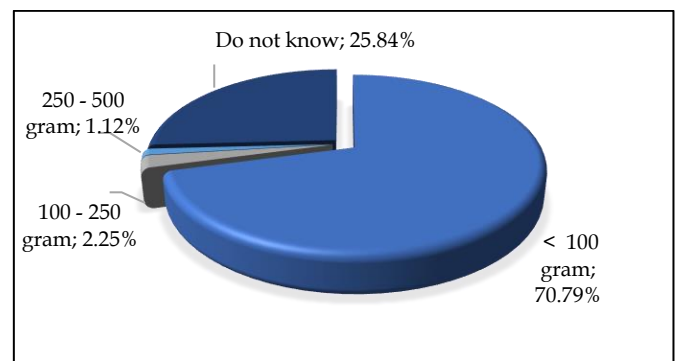

Figure 4. The Estimated Amount of Food Waste Produced per Household per Day

According to a Korean survey, roughly 63 % dispose of less than 500 g of food waste everyday (Kim & Lee, 2020). Food waste output was observed to be higher in Hanoi, with an average of 1192 grams per day per household in urban areas and 1694 grams per day per household in rural areas (Liu & Nguyen, 2020). The number of persons living in a household and the amount of food wasted has a significant correlation. Variations in age have an impact on the amount of food thrown out (Jungowska et al., 2021). Aside from age, the location of habitation has a considerable impact on the amount of food leftover (Kim & Lee, 2020). Consumer attitudes toward food waste have a direct impact on the amount of food waste produced and, as a result, on global warming implications (Flanagan & Priyadarshini, 2021). Food waste disposal is not only bad for consumers, but it is also bad for local governments' finances because they have to pay for food waste disposal and processing (Quested et al., 2013).

Saridewi villagers tried a variety of approaches to control the residual staple food they produced. Food waste was composted by 39.32 %, but 5.62 % decided to dispose of it directly (Figure 5). Due to a lack of expertise in the processing of food waste, it is thought that direct dumping is being used.
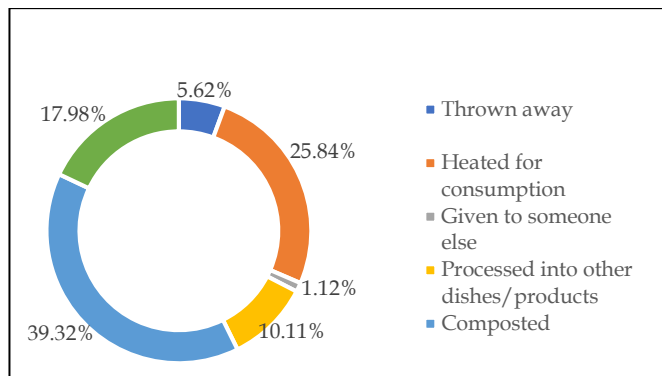

Figure 5. Alternatives for Processing Food

Poor food waste disposal procedures have a negative impact on the environment in the form of greenhouse gas emissions, leachate, odors, and pests (Oelofse & Nahman, 2013). In 100 years, piles of food waste will produce methane gas, which has a 25-fold larger global warming potential than carbon dioxide (Thyberg & Tonjes, 2016). To lower greenhouse gas emissions and increase food safety, better waste management procedures must be implemented (Oelofse & Nahman, 2013). Households don't sort garbage for a variety of reasons, including laziness, a lack of understanding, and a lack of resources (Novriadhy & Juairiyah, 2018). The goal to recycle food waste is heavily influenced by each individual's own mindset (Aschemann-Witzel et al., 2015). When consumers have stronger

intentions not to waste food, they waste less food (Zainal & Hassan, 2019).

The lack of sufficient administrative measures and low financial allocations to assist recycling efforts are the key difficulties in waste management in developing countries (Li et al., 2016). In Indonesia, people often use or treat food waste as animal feed or compost (Rachman & Septiana, 2020). Composting using anaerobic bacteria is a good approach to capture gas (Thyberg & Tonjes, 2016). Composting food waste on a small scale is simple, but composting food waste in cities is a difficult operation that necessitates effective waste management (Novriadhy & Juairiyah, 2018). In urban regions, the majority of customers give leftover food to others, whereas in rural areas, leftovers are used as animal feed and for other purposes (Liu & Nguyen, 2020).

Food Waste Potential

Residents of Saridewi divide their trash into four categories to make it easier to handle. Kitchen organic waste (food waste), garden organic waste (leaves and twigs), valuable inorganic waste (which may be recycled), and valueless inorganic waste (cannot be recycled such as diapers and cigarette butts). It reaches 30.23 kg/day for food waste created by Saridewi households (Figure 6).
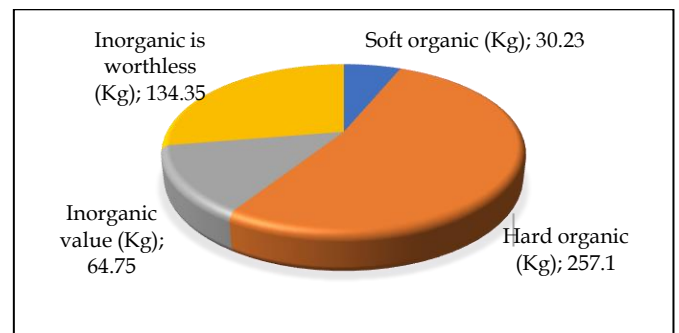

Figure 6. Production of Each Type of Waste in the Saridewi Area per Day

On average, the quantity of waste generated in the Saridewi area is 486.42 kg per day or 7.85 kilograms per household per day. Food waste represented 6.21 % amount of waste generated. If the quantity of food wastes generated by one man in one day is calculated, it equals 0.14 kg. The process of implementing zero waste over the last year has resulted in this quantity of food waste. The potential for food waste in the Saridewi area is expected to be higher if the concept of zero waste is not used. This presumption is in line with Jungowska et al., (2021), who claim that consumers who understand zero waste have a better understanding of the problem of food waste because they are more likely to determine its suitability when choosing the food they eat and have a better understanding of proper storage. Housewives'

participation has a favorable and correlational impact on the Zero Waste Behaviour Program's execution and exhibits good waste management results (Komari et al., 2011).

A survey in Turkey found that 32.9 % produce 0-1 kilograms of food waste. Moldy food, food left in the fridge for too long, and food expiration dates are all sources of food waste (Bozdag & Cakiroglu, 2021). According to research conducted in Hanoi, the average amount of food waste generated per person per day is 285 grams per day per person in urban regions and 423 grams per day per person in rural areas (Liu & Nguyen, 2020). In 2018, Bangkok's potential for food waste was predicted to be 0.38–0.61 kg per day, which is high although when compared to developed cities (Liu et al., 2020). Food waste was determined to be 0.23–2 liters per person per day in Badung City, Indonesia, according to research (Brigita & Rahardyan, 2013). Food is lost in Arab countries, and food waste per person reaches 210 kilograms per year (Abiad & Meho, 2018). Meanwhile, food waste in South Africa is estimated to be over 210 kilograms per person per year (World Wide Fund South Africa, 2017).

Production of food waste that reaches the Material Recovery Facility (MRF)

The volume of food waste that reaches the Material Recovery Facility (MRF) in each sub-district in Denpasar City ranges from 115 kg to 184.67 kg per day, according to the findings of the data analysis (Figure 7). The amount of food waste that reaches the MRF varies per sub-district since it is influenced by a variety of factors, including behavior and population density.
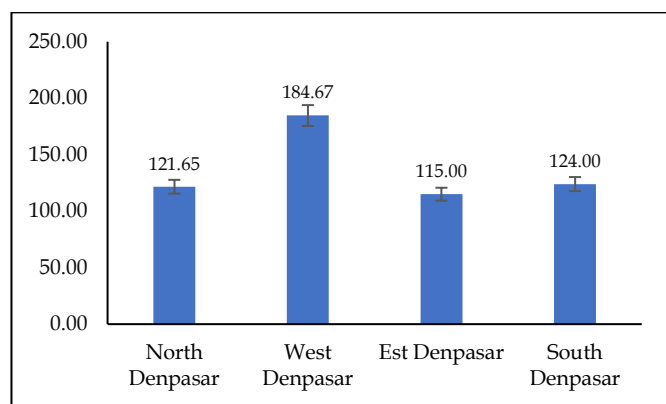

Figure 7. The Average Amount of Food Waste at MRF in Each Sub-district in Denpasar

Food waste is directly influenced by sociodemographic characteristics, food purchasing behaviors, food preparation, cooking, and consumption habits, as well as cultural views on food waste (Bozdag & Cakiroglu, 2021). Human behavior is often linked to the causes of food waste (World Wide Fund South Africa, 2017). Some patterns of food waste are the result of marketing methods used by numerous corporations, which push customers to buy more food than they require (Krisjanti & Quita, 2020).

Food is viewed as a one-time use commodity in the developed world. Approximately one-third to one-half of all food produced for human use is estimated to be wasted globally (Oelofse & Nahman, 2013). In 2019, around 931 million tonnes of food waste were generated, with 61% coming from households, 26% from food services, and 13% from shops (Forbes et al., 2021). In the United Kingdom, households contribute the most to food waste, accounting for 8.3 million tonnes per year, costing consumers £12 billion, and accounting for 3% of the country's greenhouse gas emissions (Quested et al., 2011). The disparities in the content of household food waste can be explained by different countries' eating habits (Kasza et al., 2020).

The frequency with which people buy food has a significant impact on the amount of food wasted. The more money spent on groceries in a single transaction, the more likely there is to be food waste (Kim & Lee, 2020). Food waste is produced at all phases of the food supply chain, from harvesting through production, distribution, and eventually consumption, but domestic food waste accounts for the majority of it (Marangon et al., 2014). People may be motivated to modify their thoughts and actions toward food waste if they are aware of the scope of the problem (Thyberg & Tonjes, 2016). Food waste not only has a detrimental influence on the environment, but it also contributes significantly to unjustified economic losses and social issues (Bunditsakulchai & Liu, 2021). Food waste has a significant economic impact on all persons and organizations involved in the food supply chain (Thyberg & Tonjes, 2016)

Conclusion

Saridewi residents have taken steps to manage food waste by processing it into compost, and animal feed to changing to other products as part of efforts to implement the zero waste concept. The behavior of buying groceries and ready-to-eat foods without planning is one of the driving factors for the generation of food waste. The average food waste produced by Saridewi residents who have implemented the zero waste concept reaches 0.14 kg/person/day. The potential for food waste at waste management sites in Denpasar City ranges from 115 kg-184.67 kg/day. The amount of food waste that goes to the polling station is influenced by a variety of factors, ranging from behavior to population density. The amount of food waste produced can be reduced through socialization and the

application of the concept of comprehensive zero waste in Denpasar City. Not to mention the amount of food waste in Denpasar City will be greatly influenced by the level of tourist visits, both domestic and foreign.

Author Contributions
The contribution of each author is carried out following mutual agreement, namely, I Nengah Muliarta am in charge of designing research concepts and data collection methods, as well as writing article drafts. Catur Yudha Hariani is in charge of coordination in the field related to research permits and the determination of research samples. Ni Made Indra Wahyuni is in charge of compiling questionnaires and conducting data tabulation and data analysis. Anak Agung Tatik Rismayanti is in charge of checking the final report and draft of articles, as well as translating them into English

Conflicts of Interest
We, the authors, hereby declare that there is no conflict of interest in the research we conducted. This research was made because of the interest of the authors to evaluate the implementation of the zero waste concept so that it can be a reference and guideline for the government and other researchers. The evaluation of the zero waste concept is important because Bali is a world tourist destination and is an effort to implement the zero waste concept for the first time in Bali.

References

Abiad, M. G., & Meho, L. I. (2018). Food loss and food waste research in the Arab world: a systematic review. *Food Security*, *10*(2), 311–322. https://doi.org/10.1007/s12571-018-0782-7

Aschemann-Witzel, J., de Hooge, I., Amani, P., Bech-Larsen, T., & Oostindjer, M. (2015). Consumer-related food waste: Causes and potential for action. *Sustainability (Switzerland)*, *7*(6), 6457–6477. https://doi.org/10.3390/su7066457

Bond, M., Meacham, T., Bhunnoo, R., & Benton, T. G. (2013). Food waste within global food systems. In *Global Food Security Programme*. Retrieved from https://www.foodsecurity.ac.uk/publications/food-waste-within-global-food-systems.pdf

Bozdag, A. N. S., & Cakiroglu, F. P. (2021). Determination of the factors affecting the amount of food waste generated from households in Turkey. *Future of Food: Journal on Food, Agriculture and Society*, *9*(2), 1–20. https://doi.org/10.17170/kobra-202011192214

Brigita, G., & Rahardyan, B. (2013). Analisa Pengelolaan Sampah Makanan Di Kota Bandung. *Jurnal Tehnik Lingkungan*, *19*(1), 34–45. https://doi.org/10.5614/jtl.2013.19.1.4

Bunditsakulchai, P., & Liu, C. (2021). Integrated strategies for household food waste reduction in bangkok. *Sustainability (Switzerland)*, *13*(14), 1–21. https://doi.org/10.3390/su13147651

Cequea, M. M., Neyra, J. M. V., Schmitt, V. G. H., & Ferasso, M. (2021). Household food consumption and wastage during the covid-19 pandemic outbreak: A comparison between peru and brazil. *Sustainability (Switzerland)*, *13*(14). https://doi.org/10.3390/su13147583

Davenport, M. L., Qi, D., & Roe, B. E. (2019). Food-related routines, product characteristics, and household food waste in the United States: A refrigerator-based pilot study. *Resources, Conservation and Recycling*, *150*(May). https://doi.org/10.1016/j.resconrec.2019.104440

Dewi, P. D. ., Suarna, W., & Suyasa, W. B. (2017). T Potensi Energi Listrik Yang Dihasilkan Dari Emisi Gas Metana Di Tpa Suwung Provinsi Bali. *Ecotrophic*, *11*(2), 132–139. Retrieved from https://ojs.unud.ac.id/index.php/ECOTROPHIC/article/view/32911

FAO. (2017). *Global initiative on Food Loss and Waste*. In Fao.

Flanagan, A., & Priyadarshini, A. (2021). A study of consumer behaviour towards food-waste in Ireland: Attitudes, quantities and global warming potentials. *Journal of Environmental Management*, *284*, 112046. https://doi.org/10.1016/j.jenvman.2021.112046

Forbes, H., Quested, T., & O'Connor. (2021). *Food Waste Index Report 2021*. In United Nations Environment Programme.

Gustavsson, J., Cederberg, C., Sonesson, U., & Emanuelsson, A. (2013). The methodology of the FAO study : " Global Food Losses and Food Waste - extent , causes and prevention." In *SIK report, 857*. Retrieved from https://www.diva-

portal.org/smash/get/diva2:944159/FULLTEXT0
1.pdf

Hadiningrat, G. (2020). Women's Role in Food Waste Management in Indonesia (Study Case in Bandung). In *The 1st International Scientific Meeting on Public Health and Sports*, 31–35. https://doi.org/10.2991/ahsr.k.201203.006

Jalil, E. E. A., Ying, C. W., Min, C. S., & Chen, L. M. (2019). A study of food waste behaviour in tertiary institution. *Industrial Engineering and Operations Management. Thailand*, 2756-2762. Retrieved from http://ieomsociety.org/ieom2019/papers/591.pdf

Jeswani, H. K., Figueroa-Torres, G., & Azapagic, A. (2021). The extent of food waste generation in the UK and its environmental impacts. *Sustainable Production and Consumption*, *26*, 532–547. https://doi.org/10.1016/j.spc.2020.12.021

Jungowska, J., Kulczyński, B., Sidor, A., & Gramza-Michałowska, A. (2021). Assessment of factors affecting the amount of food waste in households run by polish women aware of well-being. *Sustainability (Switzerland)*, *13*(2), 1–16. https://doi.org/10.3390/su13020976

Kasza, G., Dorkó, A., Kunszabó, A., & Szakos, D. (2020). Quantification of household food waste in hungary: A replication study using the FUSIONS methodology. *Sustainability (Switzerland)*, *12*(8), 1–14. https://doi.org/10.3390/SU12083069

Kim, S., & Lee, S. H. (2020). Examining household food waste behaviors and the determinants in Korea using new questions in a national household survey. *Sustainability (Switzerland)*, *12*(20), 1–24. https://doi.org/10.3390/su12208484

Komari, A. S., Abdulhak, I., & Heryanto, N. (2011). Sikap Ibu Rumah Tangga Terhadap Penerapan Program Zero Waste Lifestyle Di Kelurahan Sukaluyu Kota Bandung. *Jurnal Pendidikan Luar Sekolah*, *27*(02), 477–482. Retrieved from https://ejournal.upi.edu/index.php/pls/article/view/5417

Krisjanti, M. N., & Quita, A. G. (2020). Food Shopping Behavior: A Long Way to Prevent Food Waste. *Media Ekonomi Dan Manajemen*, *35*(1), 92. https://doi.org/10.24856/mem.v35i1.1251

Li, Y., Jin, Y., Li, J., Chen, Y., Gong, Y., Li, Y., & Zhang, J. (2016). Current Situation and Development of Kitchen Waste Treatment in China. *Procedia Environmental Sciences*, *31*, 40–49. https://doi.org/10.1016/j.proenv.2016.02.006

Liu, C., Mao, C., Bunditsakulchai, P., Sasaki, S., & Hotta, Y. (2020). Food waste in Bangkok: Current situation, trends and key challenges. *Resources, Conservation and Recycling*, *157*, 104779. https://doi.org/10.1016/j.resconrec.2020.104779

Liu, C., & Nguyen, T. T. (2020). Evaluation of household food waste generation in hanoi and policy implications towards SDGs target 12.3. *Sustainability (Switzerland)*, *12*(16). https://doi.org/10.3390/su12166565

Lopez Barrera, E., & Hertel, T. (2021). Global food waste across the income spectrum: Implications for food prices, production and resource use. *Food Policy*, *98*, 101874. https://doi.org/10.1016/j.foodpol.2020.101874

Marangon, F., Tempesta, T., Troiano, S., & Vecchiato, D. (2014). Food waste, consumer attitudes and behaviour. A study in the North-Eastern part of Italy. *Rivista Di Economia Agraria*, *69*(2–3), 201–209. https://doi.org/10.13128/REA-16922

Muhtarom, K. (2016). Perilaku Konsumsi Masyarakat Jakarta Timur Sebelum Dan Saat Ramadhan. *Al-Iqtishad: Journal of Islamic Economics*, *2*(2). https://doi.org/10.15408/aiq.v2i2.2485

Mulyo, R. A. (2016). *Perkiraan kehilangan pangan (food loss dan food waste) komoditas beras di indonesia riska amelia mulyo.* In Skripsi Universitas Institut pertanian Bogor.

Murray, R., & Greenpeace. (2002). *Zero waste.* Greenpeace Environmental Trust.

Novriadhy, D., & Juairiyah, O. (2018). Food Waste Management Framework to Support Sustainable Agriculture in Pagar Alam City Of South Sumatera. *Jurnal Pembangunan Nagari*, *3*(2), 1. https://doi.org/10.30559/jpn.v3i2.98

Oelofse, S. H. H., & Nahman, A. (2013). Estimating the magnitude of food waste generated in South Africa. *Waste Management and Research*, *31*(1), 80–86. https://doi.org/10.1177/0734242X12457117

Quested, T. E., Marsh, E., Stunell, D., & Parry, A. D. (2013). Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling*, *79*, 43–51. https://doi.org/10.1016/j.resconrec.2013.04.011

Quested, T. E., Parry, A. D., Easteal, S., & Swannell, R. (2011). Food and drink waste from households in the UK. *Nutrition Bulletin*, *36*(4), 460–467. https://doi.org/10.1111/j.1467-3010.2011.01924.x

Quested, T., & Johnson, H. (2012). Household Food and Drink Waste in the UK. In *October* (Issue November). Retrieved from https://wrap.org.uk/resources/report/household-food-and-drink-waste-united-kingdom-2012

Rachman, I., & Septiana, A. I. (2020). Food Waste Control Recommendations in Indonesia Based on Public Opinion Related To the Target Sdgs. *Journal of Community Based Environmental Engineering and Management*, *4*(1), 25–30. https://doi.org/10.23969/jcbeem.v4i1.2334

Ramukhwatho, F. R., Du Plessis, R., & Oelofse, S. (2016).

Household food wastage by income level : A case study of five areas in the city of Tshwane Metropolitan Municipality , Gauteng Province , South Africa. *Proceedings of the 23rd WasteCon Conference 17-21 October 2016, Emperors Palace, Johannesburg, South Africa, October*, 57–64. Retrieved from https://researchspace.csir.co.za/dspace/handle/10204/8966

Rini, T. S., Kusuma, M. N., Pratiknyo, Y. B., & Purwaningrum, S. W. (2020). Kajian Potensi Gas Rumah Kaca Dari Sektor Sampah Di Tempat Pemrosesan Akhir Sampah. *Journal of Research and Technology*, *6*(1), 97–107. Retrieved From https://journal.unusida.ac.id/index.php/jrt/article/view/145

Thyberg, K. L., & Tonjes, D. J. (2016). Drivers of food waste and their implications for sustainable policy development. *Resources, Conservation and Recycling*, *106*, 110–123. https://doi.org/10.1016/j.resconrec.2015.11.016

Truong, L., Morash, D., Liu, Y., & King, A. (2019). Food waste in animal feed with a focus on use for broilers. *International Journal of Recycling of Organic Waste in Agriculture*, *8*(4), 417–429. https://doi.org/10.1007/s40093-019-0276-4

Williams, P., & Walton, K. (2011). Plate waste in hospitals and strategies for change. *E-SPEN*, *6*(6). https://doi.org/10.1016/j.eclnm.2011.09.006

World Wide Fund South Africa. (2017). *Food Loss and Waste: Facts and Futures Taking steps towards a more sustainable food future.* In World Wide Fund.

Zachár, J. (2019). Investigation of Food Waste Generation. *Georgikon for Agriculture*, *23*(3), 197–219. Retrieved From https://www.researchgate.net/publication/336021387_INVESTIGATION_OF_FOOD_WASTE_GENERATION

Zainal, D., & Hassan, K. A. (2019). Factors Influencing Household Food Waste Behaviour in Malaysia International Journal of Research in Business, Economics and Management. *International Journal of Research in Business , Economics and Management*, *3*(3), 56–71. Retrieved From https://www.researchgate.net/profile/Dalilawati-Zainal-2/publication/334812651_Factors_Influencing_Household_Food_Waste_Behaviour_in_Malaysia/links/5d4231594585153e59325530/Factors-Influencing-Household-Food-Waste-Behaviour-in-Malaysia.pdf

Zurbrügg, C., Gfrerer, M., Ashadi, H., Brenner, W., & Küper, D. (2012). Determinants of sustainability in solid waste management - The Gianyar Waste Recovery Project in Indonesia. *Waste Management*, *32*(11), 2126–2133. https://doi.org/10.1016/j.wasman.2012.01.011