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Household Food Waste Management during COVID-19 Pandemic in Thailand and Indonesia

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Final Report

Household Food Waste Management during COVID-19 Pandemic in Thailand and Indonesia: A Case Study of Undergraduate Students

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Abstract

Three objectives of the research are to analyze food waste (FW) awareness of undergraduate students to estimate the amount of household FW and its determinants, as well as to analyze food consumption management. The sample of this study consists of 394 Srinakharinwirot (SWU) students' households and 396 Gadjah Mada University (UGM) students' households. The main results of this study reveal that although FW awareness in both cases fall into the very good and excellent categories, the average scores of the variable of FW Reduction Potential of both cases are the lowest compared to all variables. Therefore, the awareness of young generation should be raised to understand well the negative impacts of FW particularly on the issue of FW reduction potential and improvement of food consumption behavior, so they will become more responsible food consumers.

The economic losses of FW in the total households of SWU and UGM undergraduate students are supposed to be asserted because in 2023 they reach about 370,799.35 USD and 527,315.95 USD respectively. In addition, both cases reveal that the main FW items are originated from Meat, Eggs, Vegetables and Fruit, as well as Rice and noodles, while leftovers are the main contributor of the most household FW generation. The estimated Tobit model in both cases concludes that the independent variables of the age of the household head, monthly food expenditure, family size, and area where the household resides have impacts on the amount of FW with a statistical significance. Regarding the habit and attitude variables, the independent variable of moral attitude has an impact on the amount of FW with a statistical significance. Hence, the dissemination of knowledge of FW, its impact, and tips to reduce it including the empowerment of housewives through campaigns, training, and promotion about FW should be conducted to save their household food consumption spending. In addition, based on the results of food consumption management analysis, there are four variables in both the cases of SWU and UGM which are in the same category namely very good, those are Planning, Provision, Serving/Processing, and Food Waste Disposal/Utilization. Within the variables of food consumption management, the top three indicators showing high average scores can be used for the proposal of food consumption management conceptual framework to support the SWU and UGM households' responsible consumption as the 12th the Sustainable Development Goal.

Keywords: Food Waste, Food Waste Awareness, Amount of Food Waste, Tobit Model, Food Consumption Management, 12th Sustainable Development Goal

บทคัดย่อ

วัตถุประสงค์ของการวิจัยมี 3 ประการ ได้แก่ เพื่อวิเคราะห์ความตระหนักรู้ด้านขยะอาหารของนิสิตระดับปริญญาตรี รวมทั้งเพื่อประมาณปริมาณขยะอาหารของครัวเรือนและปัจจัยที่กำหนด ตลอดจนเพื่อวิเคราะห์การจัดการการบริโภคอาหาร โดยอาศัยกลุ่มตัวอย่างมีจำนวน 394 ครัวเรือนของนิสิตมหาวิทยาลัยศรีนครินทรวิโรฒ (มศว) และ 396 ครัวเรือนของนิสิตมหาวิทยาลัยกาดจาห์มาดา (UGM) ผลการศึกษาหลัก ๆ แสดงได้ดังต่อปี้ แม้ว่าการตระหนักรู้เกี่ยวกับขยะอาหารในทั้งสองกรณีถูกจัดอยู่ประเภทที่ดีมากและยอดเยี่ยม อย่างไรก็ตามคะแนนเฉลี่ยของตัวแปรศักยภาพการลดปริมาณขยะอาหารในทั้งสองกรณีนั้นค่อนข้างต่ำเมื่อเปรียบเทียบกับคะแนนเฉลี่ยของตัวแปรทั้งหมด ดังนั้นควรสร้างจิตสำนึกให้เยาวชนเข้าใจถึงผลกระทบเชิงลบของขยะอาหาร โดยเฉพาะประเด็นศักยภาพการลดปริมาณขยะอาหารและปรับปรุงพฤติกรรมการบริโภคอาหารเพื่อให้เยาวชนกลายเป็นผู้บริโภคอาหารที่มีความรับผิดชอบมากขึ้น

ความสูญเสียทางเศรษฐกิจของปริมาณขยะอาหารในครัวเรือนนิสิตระดับปริญญาตรี มศว และ UGM เป็นสิ่งที่ควรตระหนัก เนื่องจากในปี 2023 ขยะอาหารคิดเป็นมูลค่าประมาณ 370,799.35 และ 527,315.95 ดอลลาร์ สรอ. ตามลำดับ ยิ่งไปกว่านั้นทั้งสองกรณีเผยให้เห็นว่า รายการขยะอาหารหลัก ๆ มาจากประเภทเนื้อสัตว์ ไข่ ผักและผลไม้ ข้าวและเส้นก๋วยเตี๋ยว นอกจากนี้ทั้งสองกรณี พบว่า ขยะอาหารในครัวเรือนส่วนใหญ่เกิดจากอาหารที่รับประทานเหลือ ขณะเดียวกันผลการประมาณแบบจำลองโทบิท พบว่า ตัวแปรอิสระ ได้แก่ อายุของหัวหน้าครัวเรือน ค่าใช้จ่ายด้านอาหารต่อเดือน จำนวนสมาชิกในครอบครัว และลักษณะพื้นที่อยู่อาศัย มีผลต่อปริมาณขยะอาหารอย่างมีนัยสำคัญทางสถิติ สำหรับตัวแปรด้านนิสัยและทัศนคตินั้น พบว่า ตัวแปรอิสระด้านทัศนคติทางศีลธรรมมีผลกระทบต่อปริมาณขยะอาหารในครัวเรือนอย่างมีนัยสำคัญทางสถิติ ดังนั้นควรดำเนินการเผยแพร่ความรู้เรื่องขยะอาหาร ผลกระทบของขยะอาหาร และเคล็ดลับในการลดขยะ รวมทั้งการเสริมศักยภาพให้แก่แม่บ้านด้วยการรณรงค์และอบรมเกี่ยวกับขยะอาหาร ซึ่งนับเป็นการประหยัดค่าใช้จ่ายด้านอาหารในครัวเรือน นอกจากนี้จากผลวิเคราะห์การจัดการการบริโภคอาหารของครัวเรือนนิสิต มศว และ UGM พบว่า มี 4 ตัวแปร ได้แก่ การวางแผน การจัดหา การเสิร์ฟ/การแปรรูป และการกำจัด/การใช้ประโยชน์จากขยะอาหาร อยู่ในหมวดเดียวกัน นั่นคือ หมวดหมู่ดีมาก นอกจากนี้ผลการศึกษาการจัดการอาหารของครัวเรือนสามารถนำตัวบ่งชี้ 3 อันดับแรกที่มีคะแนนเฉลี่ยสูงสุดในแต่ละตัวแปรมาสร้างเป็นข้อเสนอกรอบแนวคิดการจัดการการบริโภคอาหารเพื่อสนับสนุนการบริโภคอย่างมีความรับผิดชอบของครัวเรือนในฐานะที่เป็นเป้าหมายการพัฒนาที่ยั่งยืนที่ 12

คำสำคัญ ขยะอาหาร การตระหนักรู้เกี่ยวกับขยะอาหาร ปริมาณขยะอาหาร แบบจำลองโทบิท การจัดการการบริโภคอาหาร เป้าหมายการพัฒนาที่ยั่งยืนที่ 12

Abstrak

Tiga tujuan penelitian ini adalah menganalisis kesadaran pemubaziran makanan mahasiswa S1 untuk memperkirakan jumlah pemubaziran makanan rumah tangga dan determinannya, serta menganalisis manajemen konsumsi makanan. Sampel penelitian ini terdiri dari 394 rumah tangga mahasiswa Srinakharinwirot (SWU) dan 396 rumah tangga mahasiswa Universitas Gadjah Mada (UGM). Hasil utama dari penelitian ini mengungkapkan bahwa meskipun kesadaran pemubaziran makanan pada kedua universitas masuk dalam kategori sangat baik dan sangat baik, skor rata-rata variabel potensi pengurangan pemubaziran makanan kedua kasus agak rendah dibandingkan semua variabel. Oleh karena itu, kesadaran generasi muda harus ditumbuhkan untuk memahami dengan baik dampak negatif dari pemubaziran makanan khususnya pada isu potensi penurunan pemubaziran makanan dan perbaikan perilaku konsumsi makanan, sehingga menjadi konsumen yang lebih bertanggung jawab.

Kerugian ekonomi pemubaziran makanan pada rumah tangga mahasiswa S1 SWU dan UGM pada tahun 2023 masing-masing mencapai sekitar 370.799,35 USD dan 527.315,95 USD. Selain itu, pemubaziran makanan utama berasal dari daging, telur, sayur dan buah, serta beras dan mie, sedangkan sisa makanan merupakan kontributor utama dari pemubaziran makanan rumah tangga terbanyak. Berdasarkan estimasi model Tobit pada kedua universitas tersebut dapat diketahui bahwa variabel independen usia kepala rumah tangga, pengeluaran makanan bulanan, ukuran keluarga, dan wilayah tempat tinggal rumah tangga berdampak pada jumlah pemubaziran makanan secara signifikansi. Selain itu, variabel kebiasaan dan sikap, variabel independen sikap moral berdampak pada jumlah pemubaziran makanan secara signifikan. Oleh karena itu, diperlukan sosialisasi tentang pengetahuan pemubaziran makanan, dampaknya, dan tips untuk menguranginya termasuk pemberdayaan ibu rumah tangga melalui kampanye, pelatihan, dan promosi sehingga dapat menghemat pengeluaran konsumsi makanan rumah tangga. Dari hasil analisis pengelolaan konsumsi pangan terdapat empat variabel di SWU maupun UGM yang berada pada kategori yang sama yaitu sangat baik antara lain perencanaan, penyediaan, penyajian/pengolahan, dan pembuangan/penggunaan limbah makanan. Dalam variabel pengelolaan konsumsi makanan, tiga indikator teratas tersebut menunjukkan skor rata-rata tinggi sehingga dapat digunakan sebagai usulan kerangka konseptual pengelolaan konsumsi makanan untuk mendukung konsumsi rumah tangga yang bertanggung jawab SWU dan UGM serta sebagai Tujuan Pembangunan Berkelanjutan ke-12.

Kata kunci: Sampah Makanan, Kesadaran Sampah Makanan, Jumlah Sampah Makanan, Model Tobit, Pengelolaan Konsumsi Makanan, Tujuan Pembangunan Berkelanjutan ke-12

Executive Summary

The COVID-19 pandemic disrupted every aspect of human existence, including health, education, and economy. Both Srinakharinwirot University (SWU) in Thailand and Universitas Gadjah Mada (UGM) in Indonesia shared the similar problem where the consumption patterns of their students were altered due to the increasing quantity and quality of their home-cooked meals. The primary concern is that the pandemic will disrupt not only the household purchasing power of the undergraduate students but also their consumption patterns, including the quantity of food that is not consumed or wasted. In light of the significance of food waste impact on households, communities, countries (Thailand and Indonesia), as well as ASEAN, this project investigates the following issues: (i) Are SWU and UGM undergraduate students aware of food waste issues? (ii) How much is the amount of household food waste of SWU and UGM undergraduate students? (iii) What factors contribute to household food waste of SWU and UGM undergraduate students? and (iv) How do the households of SWU and UGM undergraduate students manage their food waste?

In terms of research methodology, the sample of this study is 394 SWU students' households and 396 UGM students' households. The research proposal, questionnaire, and documents of Focus Group Discussions/in-depth interview were approved by the research ethics committee of SWU and UGM (Approval Code: SWUEC/E-256/2022 and KE/UGM/043/EC/2022). All the indicators and variables of the questionnaire collected from 440 samples were able to reject the null hypothesis in the validity and reliability tests with statistical significance. In online survey, the students answered Part 1 of the questionnaire on FW awareness, while the heads of households who were mainly in charge of the food consumption at home or the wives of the heads of households answered Part II and III of the questionnaire on household food waste behavior and food consumption management. The data analysis was separated into four parts as follows: First part was FW awareness which was analyzed by the statements using 5-point Likert scale searching the answers related to personal awareness of FW. In the second part, the data on the amount of household FW were estimated. The data were derived from generating household FW within one day. Next, Tobit model was generated to find out the factors that influence the amount of FW in the third part, and the last part analyzed food consumption management. Subsequently, we measured the statements using 5-point Likert scale which were related to planning, providing food, preparation, serving/processing, storage, and food waste disposal/utilization.

The main results are concluded as follows: Although FW awareness in both cases is classified into very good and excellent categories, the average scores of FW Reduction Potential in both cases are the lowest compared to all variables. Therefore, it is crucial to raise the awareness of young generation of the negative impacts of FW particularly on the issue of FW reduction potential and improvement of food consumption behavior in order that they will become more responsible food consumers. Based on the results of statistics comparing the two groups, the z-statistics and p-value reflect that the average

values of all variables in the case of UGM are greater than those of SWU with a statistical significance. This may be because UGM undergraduate students have a better perception of understanding food waste. This perception is closely related to the aspects of household knowledge and habits in treating food waste which are repeated, so it becomes the culture of Indonesian society. Therefore, SWU policymakers can learn from the experience of UGM in which UGM facilitates the waste management programs by establishing the Recycling Innovation House facilities at the AgroTechnology Innovation Center. This facility is useful for learning the knowledge and information about waste management.

In 2023 the estimated amount of FW from the households of SWU and UGM undergraduates is about 42.78 kg/capita and 24.50 kg/capita respectively. Moreover, both cases reveal that the main FW items are originated from Meat, Eggs, Vegetables and Fruit, as well as Rice and noodles. In addition, both cases find that most household FW is generated from leftovers. Therefore, the dissemination of knowledge of FW, its impact, and tips to reduce it including the empowerment of housewives through campaigns, training, and promotion about FW should be conducted to save their household food consumption spending. Apart from this, in terms of economic perspective, in 2023 the total values of SWU and UGM undergraduates' household FW are around 370,799.35 USD and 527,315.95 USD respectively. These values represent the economic losses which can be reallocated into the public budgets which the Thai and Indonesian governments can spend on more economically productive activities.

As the main results of food consumption management (FCM) analysis, there are four variables in both the cases of SWU and UGM that are in the same category namely very good, those are Planning, Provision Serving/Processing, and Food Waste Disposal/Utilization. On the other hand, according to the results of statistics comparing the two groups, the average scores of the variables of Preparing and Food Waste Disposal/Utilization in the case of UGM are greater than those of SWU with a statistical significance. This may be because around 54% of the respondents from UGM households live in rural areas, with respect to the traditional culture of cooking preparation and food waste utilization. They can cook with the leftover ingredients, and if there are still leftovers, they will give to their livestock or their neighbors. The average score of Storage variable of SWU is greater than that of UGM. This may be because around 64% of the respondents from SWU households live in urban areas. Moreover, around 75% of the respondents strongly agree/agree that they buy groceries/foods at the supermarket. Most groceries/foods present the expiration date on their packages thus easily for food arrangement by expiration date. Besides, within the variables of FCM, the top three indicators showing high average scores can be used for the proposal of FCM conceptual framework to support SWU and UGM households' responsible consumption as the 12th the Sustainable Development Goal. Also, it can be adjusted for other cases in ASEAN countries.

บทสรุปผู้บริหาร

การระบาดใหญ่ของโควิด-19 ได้ส่งผลกระทบต่อการดำรงอยู่ของมนุษย์ในทุกด้านรวมถึงสุขภาพ การศึกษา เศรษฐกิจ และด้านอื่นๆ ทั้งนี้มหาวิทยาลัยศรีนครินทรวิโรฒ (มศว) ในประเทศไทย และมหาวิทยาลัยกาดจาห์มาดา (UGM) ในอินโดนีเซียต่างก็ประสบปัญหาที่คล้ายคลึงกัน โดยรูปแบบการบริโภคของนิสิตเปลี่ยนไปเนื่องจากปริมาณและคุณภาพของอาหารปรุงเองที่บ้านเพิ่มขึ้น ซึ่งความกังวลหลัก ๆ คือ การแพร่ระบาดนั้นไม่เพียงแต่ส่งผลกระทบต่อกำลังซื้อของครัวเรือนของนิสิตระดับปริญญาตรีเท่านั้น แต่ยังรวมถึงรูปแบบการบริโภคของนิสิตด้วย รวมถึงปริมาณอาหารที่ไม่ได้บริโภคหรือขยะอาหาร ทั้งนี้ด้วยความสำคัญของผลกระทบของขยะอาหารต่อระดับครัวเรือน ชุมชน ประเทศ (ไทยและอินโดนีเซีย) รวมถึงระดับอาเซียน โครงการนี้จึงศึกษาประเด็นต่อไปนี้ (๑) นิสิตระดับปริญญาตรีของ มศว และ UGM ตระหนักถึงปัญหาขยะอาหารหรือไม่ (๒) ปริมาณขยะอาหารในครัวเรือนของนิสิตระดับปริญญาตรีของ มศว และ UGM มีปริมาณเท่าไหร่ (๓) ปัจจัยใดที่ทำให้เกิดขยะอาหารในครัวเรือนนิสิตระดับปริญญาตรีของ มศว และ UGM และ (๔) ครัวเรือนของนิสิตระดับปริญญาตรีของ มศว และ UGM จัดการขยะอาหารอย่างไร

ในด้านของวิธีวิทยาการวิจัย กลุ่มตัวอย่าง คือ ครัวเรือนของนิสิต มศว จำนวน ๓๙๔ ครัวเรือน และครัวเรือนของนิสิต UGM จำนวน ๓๙๖ ครัวเรือน ทั้งนี้ข้อเสนอโครงการวิจัย แบบสอบถาม และเอกสารสำหรับการประชุมกลุ่มย่อย/การสัมภาษณ์เชิงลึกได้รับการอนุมัติจากคณะกรรมการจริยธรรมวิจัยของ มศว และ UGM (รหัสอนุมัติ: SWUEC/E-256/2022 และ KE/UGM/043/EC/2022) ซึ่งตัวแปรและดัชนีในแบบสอบถามสามารถปฏิเสธสมมติฐานหลักในการทดสอบความน่าเชื่อถือและความสมเหตุสมผลอย่างมีนัยสำคัญทางสถิติด้วยจำนวนตัวอย่าง ๔๔๐ ตัวอย่าง สำหรับการสำรวจแบบบออนไลน์นั้นนิสิตนักศึกษาตอบแบบสอบถามในส่วนที่ ๑ เกี่ยวกับการตระหนักรู้ด้านขยะอาหาร ขณะที่หัวหน้าครัวเรือนผู้ที่รับผิดชอบหลักด้านการบริโภคอาหารหรือภรรยาของหัวหน้าครัวเรือนตอบแบบสอบถามในส่วนที่ ๒ และ ๓ เกี่ยวกับขยะอาหารของครัวเรือน และการจัดการการบริโภคอาหาร ทั้งนี้การวิเคราะห์ข้อมูลแบ่งออกเป็น ๔ ส่วน ส่วนแรก คือ การตระหนักรู้ด้านขยะอาหาร ซึ่งวิเคราะห์ด้วยข้อความที่ใช้มาตรวัดของลิเคิร์ท ๕ ระดับ เพื่อค้นหาคำตอบที่เกี่ยวข้องกับการตระหนักรู้เกี่ยวกับขยะอาหารส่วนบุคคล สำหรับในส่วนที่สอง การประมาณปริมาณขยะอาหารของครัวเรือน ซึ่งข้อมูลได้มาจากปริมาณขยะอาหารของครัวเรือนภายในหนึ่งวันที่ผ่านมา หลังจากนั้นในส่วนที่สามแบบจำลองโทบิทถูกสร้างขึ้นเพื่อค้นหาปัจจัยที่มีอิทธิพลต่อปริมาณขยะอาหาร และส่วนสุดท้ายการจัดการการบริโภคอาหารวิเคราะห์ด้วยข้อความที่ใช้มาตรวัดของลิเคิร์ท ๕ ระดับ ซึ่งเกี่ยวข้องกับการวางแผน การจัดหาอาหาร การเตรียม การเสิร์ฟ/การแปรรูป การจัดเก็บ และการกำจัด/การใช้ประโยชน์จากขยะอาหาร

สรุปผลการศึกษาหลัก ๆ ได้ดังต่อไปนี้ แม้ว่าการตระหนักรู้เกี่ยวกับขยะอาหารของนิสิตในทั้งสองกรณีจะจัดอยู่ในประเภทดีมากและดีเยี่ยม อย่างไรก็ตามคะแนนเฉลี่ยเกี่ยวกับการรับรู้ด้านศักยภาพการลดขยะอาหารในทั้งสองกรณีนั้นต่ำที่สุดเมื่อเทียบกับตัวแปรทั้งหมด ดังนั้นจึงจำเป็นอย่างยิ่งที่จะต้องสร้างความตระหนักรู้แก่เยาวชนรุ่นใหม่ถึงผลกระทบด้านลบของขยะอาหาร โดยเฉพาะประเด็นศักยภาพการลดขยะอาหาร และการปรับปรุงพฤติกรรมการบริโภคอาหาร เพื่อให้นิสิตกลายเป็นผู้บริโภคอาหารอย่างมีความรับผิดชอบมากขึ้น

นอกจากนี้จากผลของสถิติเปรียบเทียบทั้งสองกลุ่ม เมื่อพิจารณาค่าสถิติ Z และค่าความน่าจะเป็น (p-value) สะท้อนให้เห็นว่าค่าเฉลี่ยของตัวแปรทั้งหมดในกรณีของ UGM มีค่ามากกว่าของ มศว อย่างมีนัยสำคัญทางสถิติ อาจเนื่องมาจากนิสิตระดับปริญญาตรีของ UGM มีความเข้าใจที่ดีเกี่ยวกับขยะอาหาร ซึ่งการตระหนักรู้เหล่านี้สัมพันธ์อย่างแนบแน่นกับความรู้ในครัวเรือนและนิสัยในการจัดการขยะอาหารที่ทำซ้ำๆ จนกลายเป็นวัฒนธรรมของสังคมอินโดนีเซีย ดังนั้น ผู้กำหนดนโยบายของ มศว สามารถเรียนรู้จากประสบการณ์ของ UGM ซึ่งมีการดำเนินงานโครงการการจัดการของเสีย โดยการจัดตั้งศูนย์นวัตกรรมรีไซเคิล ที่ศูนย์นวัตกรรมเทคโนโลยีการเกษตร สถานที่นี้มีประโยชน์สำหรับการเรียนรู้และข้อมูลเกี่ยวกับการจัดการขยะ

ในปี ๒๕๖๖ ปริมาณขยะอาหารจากครัวเรือนนิสิตระดับปริญญาตรี มศว และ UGM อยู่ที่ประมาณ ๔๒.๗๘ กก./คน และ ๒๔.๔๕ กก./คน ตามลำดับ ยิ่งไปกว่านั้นทั้งสองกรณีเผยให้เห็นว่า ขยะอาหารหลัก ๆ มาจากราการอาหารประเภทเนื้อสัตว์ ไข่ ผักและผลไม้ ข้าวและเส้นก๋วยเตี๋ยว นอกจากนี้ทั้งสองกรณี พบว่า ขยะอาหารของครัวเรือนส่วนใหญ่มาจากอาหารที่รับประทานเหลือ ดังนั้นการเผยแพร่ความรู้เกี่ยวกับขยะอาหาร ผลกระทบของขยะอาหาร และเคล็ดลับในการลดขยะ รวมทั้งการเสริมศักยภาพให้แก่แม่บ้านด้วยการรณรงค์และอบรมเกี่ยวกับขยะอาหาร ซึ่งนับเป็นการประหยัดค่าใช้จ่ายด้านอาหารในครัวเรือน นอกเหนือจากนี้ในแง่ของเศรษฐกิจแล้ว ในปี ๒๕๖๖ ปริมาณขยะอาหาหารของครัวเรือนนิสิตระดับปริญญาตรี มศว และ UGM คิดเป็นมูลค่าอยู่ที่ประมาณ ๓๗๐,๗๙๙.๓๕ และ ๕๒๗,๓๑๕.๙๕ ดอลลาร์ สรอ. ตามลำดับ มูลค่าเหล่านี้แสดงถึงความสูญเสียทางเศรษฐกิจ ซึ่งรัฐบาลไทยและอินโดนีเซียสามารถจัดสรรเป็นงบประมาณสาธารณะที่สามารถนำไปใช้ในกิจกรรมที่มีประสิทธิผลทางเศรษฐกิจมากขึ้น

จากผลการศึกษาที่สำคัญเกี่ยวกับการวิเคราะห์การจัดการการบริโภคอาหาร พบว่า มีสี่ตัวแปรทั้งในกรณีของ มศว และ UGM ได้แก่ การวางแผน การเตรียม การเสิร์ฟ/การแปรรูป และการกำจัด/การใช้ประโยชน์เศษอาหาร ที่จัดอยู่ในประเภทเดียวกัน คือ ดีมาก ขณะที่จากผลการศึกษาเชิงสถิติเปรียบเทียบทั้งสองกลุ่ม พบว่า คะแนนเฉลี่ยของตัวแปรการเตรียม และการกำจัด/การใช้ประโยชน์จากขยะอาหาร ในกรณีของ UGM มีค่ามากกว่าของ มศว อย่างมีนัยสำคัญทางสถิติ อาจเนื่องมาจากประมาณร้อยละ ๕๔ ของผู้ตอบแบบสำรวจจากครัวเรือน UGM อาศัยอยู่ในพื้นที่ชนบทย่อมคำนึงถึงวัฒนธรรมดั้งเดิมของการเตรียมอาหารและการใช้ประโยชน์จากขยะอาหาร ซึ่งครัวเรือนในชนบทสามารถปรุงอาหารด้วยวัตถุดิบที่เหลือใช้ รวมทั้งหากยังมีอาหารเหลืออยู่ครัวเรือนก็มักใช้เลี้ยงปศุสัตว์หรือแจกจ่ายให้แก่เพื่อนบ้าน สำหรับคะแนนเฉลี่ยของตัวแปรการด้านการเก็บรักษาอาหารในกรณี มศว มีค่ามากกว่ากรณีของ UGM อาจเนื่องมาจากประมาณร้อยละ ๖๔ ของผู้ตอบแบบสอบถามจากครัวเรือน มศว อาศัยอยู่ในเขตเมือง ยิ่งไปกว่านั้นประมาณร้อยละ ๗๕ ของผู้ตอบแบบสอบถามเห็นด้วยเป็นอย่างยิ่งว่า ครัวเรือนซื้อของชำ/อาหารที่ซูเปอร์มาร์เก็ต ซึ่งของชำ/อาหารส่วนใหญ่ที่ซูเปอร์มาร์เก็ตส่วนใหญ่แสดงวันหมดอายุไว้บนบรรจุภัณฑ์ ดังนั้นจึงง่ายต่อการจัดการอาหารตามวันหมดอายุ นอกจากนี้ตัวบ่งชี้สามอันดับแรกที่มีคะแนนเฉลี่ยสูงสุดภายในตัวแปรแต่ละตัวของการจัดการการบริโภคอาหารสามารถนำมาใช้สำหรับข้อเสนอของกรอบแนวคิดสำหรับครัวเรือนของนิสิต มศว และ UGM ในการจัดการการบริโภคอาหารเพื่อสนับสนุนการบริโภคอย่างรับผิดชอบ ซึ่งเป็นเป้าหมายการพัฒนาที่ยั่งยืนลำดับที่ ๑๒ และสามารถนำกรอบความคิดดังกล่าวไปปรับใช้กับกรณีอื่น ๆ ในกลุ่มประเทศอาเซียนได้

Ringkasan

Pandemi COVID-19 memengaruhi setiap aspek keberadaan manusia, termasuk kesehatan, pendidikan, dan ekonomi. Srinakharinwirot University (SWU) di Thailand dan Universitas Gadjah Mada (UGM) di Indonesia memiliki masalah yang sama di mana pola konsumsi siswa berubah karena meningkatnya kuantitas dan kualitas makanan yang dimasak sendiri. Kekhawatiran utama adalah bahwa pandemi ini akan mengganggu tidak hanya daya beli rumah tangga siswa sarjana tetapi juga pola konsumsi, termasuk jumlah makanan yang tidak dikonsumsi atau terbuang. Mengingat pentingnya dampak pemubaziran makanan pada rumah tangga, komunitas, negara (Thailand dan Indonesia), serta ASEAN, penelitian ini mengkaji isu-isu berikut: (i) Apakah mahasiswa sarjana SWU dan UGM menyadari masalah pemubaziran makanan? (ii) Berapakah jumlah pemubaziran makanan rumah tangga mahasiswa SWU dan UGM? (iii) Faktor apa yang berkontribusi terhadap pemubaziran makanan rumah tangga mahasiswa SWU dan UGM? dan (iv) Bagaimana rumah tangga mahasiswa sarjana SWU dan UGM mengelola pemubaziran makanan?

Dari segi metodologi penelitian, sampel penelitian ini adalah 394 rumah tangga mahasiswa SWU dan 396 rumah tangga mahasiswa UGM. Proposal penelitian, kuesioner, dan dokumen Focus Group Discussion/in-depth interview disetujui oleh komite etik penelitian SWU dan UGM (Kode Persetujuan: SWUEC/E-256/2022 dan KE/UGM/043/EC/2022). Semua indikator dan variabel kuesioner yang dikumpulkan dari 440 sampel mampu menolak hipotesis nol dalam uji validitas dan reliabilitas karena signifikansi secara statistik. Dalam survei online, siswa menjawab Bagian 1 kuesioner tentang kesadaran pemubaziran makanan, sedangkan kepala rumah tangga yang terutama bertanggung jawab atas konsumsi makanan di rumah atau istri kepala rumah tangga menjawab Bagian II dan III kuesioner tentang rumah tangga perilaku membuang makanan dan manajemen konsumsi makanan. Analisis data dibagi menjadi empat bagian sebagai berikut: Bagian pertama adalah kesadaran pemubaziran makanan yang dianalisis dengan pernyataan-pernyataan menggunakan skala Likert 5 poin mencari jawaban terkait kesadaran pribadi pemubaziran makanan. Pada bagian kedua, data jumlah pemubaziran makanan rumah tangga juga diestimasi. Data tersebut diperoleh dari pemubaziran makanan rumah tangga dalam satu hari. Selanjutnya, dianalisi menggunakan model Tobit untuk mengetahui faktor-faktor yang mempengaruhi jumlah pemubaziran makanan pada bagian ketiga, dan bagian terakhir menganalisis manajemen konsumsi makanan dan mengukur pernyataan dengan menggunakan skala Likert 5 poin yang terkait dengan perencanaan, penyediaan makanan, persiapan, penyajian/pengolahan, penyimpanan, dan pembuangan/pemanfaatan limbah makanan.

Hasil utama penelitian sebagai berikut: walaupun kesadaran pemubaziran makanan pada SWU dan UGM tergolong dalam kategori sangat baik dan sangat baik, skor rata-rata potensi pengurangan pemubaziran makanan pada kedua kasus agak rendah dibandingkan semua variabel. Oleh karena itu, sangat penting untuk meningkatkan kesadaran generasi muda tentang dampak negatif pemubaziran makanan terutama pada isu potensi penurunan pemubaziran makanan dan perbaikan perilaku konsumsi makanan agar menjadi konsumen yang lebih bertanggung jawab. Berdasarkan hasil statistik yang membandingkan kedua

kelompok, z-statistik dan p-value mencerminkan bahwa nilai rata-rata semua variabel kasus UGM lebih besar daripada SWU karena signifikan secara statitisk. Hal ini mungkin karena mahasiswa S1 UGM memiliki persepsi yang lebih baik dalam memahami pemubaziran makanan. Persepsi ini terkait erat dengan aspek pengetahuan dan kebiasaan rumah tangga dalam mengolah sisa makanan yang berulang-ulang sehingga menjadi budaya masyarakat Indonesia. Oleh karena itu, pengambil kebijakan SWU dapat belajar dari pengalaman UGM dimana UGM memfasilitasi program pengelolaan sampah dengan mendirikan fasilitas Rumah Inovasi Daur Ulang di Pusat Inovasi Agroteknologi UGM. Fasilitas ini berguna untuk mempelajari pengetahuan dan informasi tentang pengelolaan sampah.

Pada tahun 2023 perkiraan jumlah pemubaziran makanan dari rumah tangga mahasiswa S1 SWU dan UGM masing-masing sekitar 42,78 kg/kapita dan 24,50 kg/kapita. Selain itu, kedua universitas tersebut memiliki pemubaziran makanan utama berasal dari daging, telur, sayur dan buah, serta beras dan mie. Selain itu, diketahui bahwa sebagian besar pemubaziran makanan rumah tangga dihasilkan dari sisa makanan. Oleh karena itu, sosialisasi pengetahuan tentang pemubaziran makanan, dampaknya, dan tips untuk menguranginya termasuk pemberdayaan ibu rumah tangga melalui kampanye, pelatihan, dan promosi tentang pemubaziran makanan harus dilakukan untuk menghemat pengeluaran konsumsi makanan rumah tangga. Selain itu, dari segi ekonomi, pada tahun 2023 total nilai FW S1 SWU dan UGM masing-masing sekitar 370.799,35 USD dan 527.315,95 USD. Nilai-nilai ini mewakili kerugian ekonomi yang dapat dialokasikan kembali ke dalam anggaran publik yang dapat dibelanjakan oleh pemerintah Thailand dan Indonesia untuk kegiatan yang lebih produktif secara ekonomi.

Sebagai hasil utama dari analisis manajemen konsumsi makanan, terdapat empat variabel di SWU maupun UGM yang berada pada kategori yang sama yaitu sangat baik antara lain perencanaan, penyediaan, penyajian/pengolahan, dan pembuangan/pemanfaatan limbah makanan. Sebaliknya, menurut hasil statistik yang membandingkan kedua kelompok, skor rata-rata variabel penyiapan dan pembuangan/pemanfaatan limbah makanan UGM lebih besar daripada SWU yang signifikan scara statistik. Hal ini mungkin karena sekitar 54% responden dari rumah tangga UGM tinggal di pedesaan, sehubungan dengan budaya tradisional memasak dan pemanfaatan sisa makanan. Mereka bisa memasak dengan bahan sisa, dan jika masih ada sisa, mereka akan memberikannya kepada ternak atau tetangga mereka. Skor rata-rata variabel penyimpanan SWU lebih besar dari UGM. Hal ini mungkin karena sekitar 64% responden dari rumah tangga SWU tinggal di perkotaan. Selain itu, sekitar 75% responden sangat setuju/setuju membeli bahan makanan/sembako di supermarket. Sebagian besar bahan makanan/makanan mencantumkan tanggal kedaluwarsa pada kemasannya sehingga memudahkan pengaturan makanan berdasarkan tanggal kedaluwarsa. Dalam variabel manajemen konsumsi makanan, tiga indikator teratas yang menunjukkan skor rata-rata tinggi dapat digunakan untuk proposal kerangka kerja konseptual manajeman konsumsi makanan untuk mendukung konsumsi rumah tangga yang bertanggung jawab di SWU dan UGM serta sebagai Tujuan Pembangunan Berkelanjutan ke-12. Hal tersebut dapat disesuaikan dengan kasus lain di negara-negara ASEAN.

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Chapter 1

Introduction

1.1 Problem Statement

The Covid-19 pandemic has disrupted almost all aspects of human life, including health, education, economy, and others. In the economic sector, it prompted social restriction, resulting in the cessation or disruption in the capital markets, offices, business sector, and various other productive activities (Ozili and Arun, 2020). After the novel pandemic began its global assaults, the universities in Thailand suddenly shifted their face-to-face classrooms into forced 100% online learning (Imsa-ard, 2020). At the same time, the pandemic made all the universities in Indonesia divert their learning process from meeting in person into online mode with limited resources and very short on time. The approaches, methods, and mechanisms of the learning process were adjusted during the pandemic and extremely varied among universities (Padmo et al., 2020).

Certainly, both Srinakharinwirot University (SWU) in Thailand and Gadjah Mada University (UGM) in Indonesia faced such issues. The SWU and UGM undergraduate students stayed at home for online learning during the Covid-19 pandemic. Nowadays, in Thailand and Indonesia, the Covid-19 incidence has significantly decreased in number, so most courses in the universities were back into on-site teaching in the first semester of 2022. However, the Center for Disease Control and Prevention (CDC) reported that Omicron variant spread more easily than the earlier variants of the Covid-19 virus, including Delta variant. On the other hand, Omicron impact was less severe than that of the prior variants.[1] Therefore, most infected undergraduate students could be quarantined at home for at five to ten days. Consequently, their consumption pattern would change because of the increase in quantity and quality of meals at home. The key issue is that the pandemic will disrupt not only the purchasing power of undergraduate students' household but also their consumption pattern, including the amount of food that is not consumed and food waste.

Food waste, in fact, is related to not only the amount of household income but also various factors, such as culture, demographics, and habit of consuming food. Bravi et al. (2020)

[1] https://www.cdc.gov/coronavirus/2019-ncov/variants/omicron-variant.html , [2022 Aug, 19]

states that several factors related to food waste include in-store behavior, storage practices, and food management at home. The Food and Agriculture Organization (FAO) estimates that 1.3 billion tons of food are wasted annually. This figure is significant because there are still many people in other parts of the world who experience hunger. The amount of food waste has an important impact on food availability, puts a pressure on water availability, causes loss of biodiversity, and increases greenhouse gas emission. Ingram et al. (2013) and Septianto et al. (2020) explicitly state that food waste has a significant effect on decreasing level of food security, so food waste also has a negative impact on the sustainability of development. Apart from this, one of the results of a study conducted by Amicarelli et al. (2021) and Amicarelli and Bux (2021) shows that the growth of food delivery system during the COVID-19 pandemic has an impact on increasing consumer awareness of choosing and buying food so that the amount of the resulting waste has decreased.

Based on the Indonesia's Ministry of National Development Planning, in 2021, the enormous food loss and waste generation occur at the consumption stage resulting in 5-19 million tons/year of food waste generation. Meanwhile, in 2014, 42.10% of waste composition in the transfer stations of Bangkok City, Thailand was food waste[2]. United Nations Environment Programme (2021) reports that Indonesia and Thailand's household food waste estimate is 77 and 79 kg/capita/year, respectively. However, the confidence level in the estimate is medium and very low. In addition, at the national level, a study in Lebanon conducted by Chalak et al. (2019) shows that the amount of food waste in urban areas is around 0.2 kg/capita/day. This amount is equivalent to 451.2 kcal, 37.5 g carbohydrates, 14.9 g protein, 2.9 g dietary fiber, 2.4 g vitamin D, 165.2 mg calcium, and 343.2 mg potassium. Fami et al. (2019) state that the amount of food waste in Oman is around 68-150 kg/person/year, in Iraq 62-76 kg/person/year, in Turkey 116 kg/person/year (Pekcan et al., 2006), and in Tehran, Iran 27 kg/person/year.

Food waste reduction is one of the Sustainable Development Goals (SDGs) number 12 on Responsible Consumption and Production. Goal 12.3 has two components: losses and waste which should be measured by two separate indicators. As in Sub-Indicator 12.3.1.b - Food Waste Index, a proposal to measure Food Waste, which comprises the retail and consumption level, is under development. Reducing food waste is one of the United Nations' sustainable

[2] https://www.seisakukikaku.metro.tokyo.lg.jp/en/diplomacy/pdf/1501-10-shigen-e.pdf , [2022, May 10]

development goals, and the United Nations Development Program (UNDP) has targeted a 50% reduction by the year 2030[3].

There are currently 213 million young people (15-34 years old) in ASEAN countries, making the largest-ever cohort of youth. The peak population of just over 220 million is expected in 2038. Youth is an important sector of the population where the attention needs to be focused as they are leaders and catalysts for the economic, social, and cultural development.[4] Furthermore, "Generation Z" referring to those who were born from 1997 to 2012 and in the age range of 9 to 24 in 2021, are the relatively large proportion of the ASEAN population. Estimated as 24% of the population, Gen Z is a generation that has an impact on society and economy.[5] Burlea-Schiopoiu et al. (2021) states that the COVID-19 pandemic has increased the youth awareness of appreciating food and environmental consequences of food waste.

According to the 2022 Global Hunger Index scores, Thailand and Indonesia face moderate level of hunger and rank at 56 and 77 respectively from 121 countries (Resnick et. al., 2022). Therefore, considering the importance of the impact of food waste on households, communities, countries (Thailand and Indonesia), and ASEAN, it is necessary to conduct a comprehensive study, especially related to young consumers' awareness of food waste like this study on the changing consumption patterns of SWU and UGM undergraduate students during the COVID-19 pandemic which is also related to their household food waste generation, the factors that affect the amount of food waste, and their food waste management. Subsequently, an in-depth study of the dynamics of food waste is expected to be conducted to provide important benefits for national (Thailand and Indonesia) and ASEAN development, especially those related to not only the efficient use of agricultural resources, strengthening food security, improving community welfare, and formulating effective strategies to mitigate food waste, but also ensuring the sustainable consumption as the important part of SDG 12: Responsible Consumption and Production.

[3] https://www.fao.org/sustainable-development-goals/indicators/1231/en/ , [2022, May 10]
[4] https://asean.org/asean2020/wp-content/uploads/2021/01/First-ASEAN-Youth-Development-Index.pdf , [2022 Aug, 19]
[5] https://www.hakuhodo-global.com/wp_admin/wp-content/uploads/2021/04/RL210408_HILL-ASEAN-Forum2021_F.pdf , [2022 Aug, 19]

1.2 Research Objectives

The main purpose of this research project is to analyze household food waste management during the COVID-19 pandemic in Thailand and Indonesia. Specifically, the project aims at exploring the following questions:

(i) Are SWU and UGM undergraduate students aware of the issues of food waste?

(ii) How much is the amount of household food waste of SWU and UGM undergraduate students?

(iii) What are the factors causing household food waste of SWU and UGM undergraduate students?

(iv) How do the households of SWU and UGM undergraduate students manage their food waste?

1.3 Expected Benefits of Research

After achieving the research objectives, the expected outputs are as follows: (i) Empirical evidence of food waste awareness of SWU and UGM undergraduate students. (ii) Estimation of the amount of household food waste of SWU and UGM undergraduate students categorized in different food groups. (iii) Estimated Tobit model to present the important factors causing household food waste of SWU and UGM undergraduate students. (iv) Valuable information on household food waste management of SWU and UGM undergraduate students. In addition, the implication of the research project is to present some policy recommendations for household food waste management in Thailand and Indonesia.

The users who benefit from the expected outputs of this research are the policymakers of Srinakharinwirot University and Gadjah Mada University. In terms of the outcome of the research, to support the SDG target 12.3 in Thailand and Indonesia, SWU and UGM can use these recommendations for strategic planning of household food waste management. Moreover, ASEAN universities can apply the outputs of this research project to their household food waste management.

Aside from the expected benefits of this research for the university policy, through the results of the study and to support the achievement of SDG 12 targets for Thailand, Indonesia,

and ASEAN, strategic policy recommendations are needed, especially related to the management of sustainable food consumption at the household level. The strategic policy recommendations are expected to:

(i) Build the awareness of younger generation to understand the negative impacts of food waste and improve their food consumption behavior to become the responsible food consumers and significantly contribute to reducing food waste at the household level.

(ii) Make a collaboration with the Ministry of Education and local governments to early introduce the students to the knowledge about food waste, the causes of food waste, and the tips to reduce it.

(iii) Be disseminated and empower the housewives through campaigns, training, and promotion about food waste, its impacts, and tips to reduce the waste in order to save their household food consumption spending. This is important because in general, housewives are the decision-makers in household food consumption.

(iv) Provide trainings for the heads of households or the wives of the heads of households who are mainly in charge of food consumption management at home including planning, providing food, preparation, serving/processing, storage, and food waste disposal/usage to reduce food waste and to support responsible consumption as one of the SDG 12 targets.

1.4 Scope of the Study

To attain the research objectives, the unit of analysis was concentrated on the sample group of SWU and UGM undergraduate students and their household heads or the wives of the heads of households who were mainly in charge of food consumption at home and the students. In terms of online survey research, the structured questionnaires and focus group discussion as well as in-depth interview techniques were utilized for primary data collection. Furthermore, 21 questions about food waste were designed for a 24-hour dietary recall survey on the heads of the households (Appendix A.). The quantitative analysis consisted of descriptive analysis, statistical analysis, Tobit model estimation, and statistical comparison between two groups.

1.5 Literature Review

Related to the research objectives, the literature review was grouped into three, namely Food Waste Awareness, Determinants of the Amount of Household Food Waste, and Food Waste Management. The summary of the determinant of the amount of Household food waste is illustrated in Table 1.1, and the details of each group are presented as follows.

(1) Food Waste Awareness

It is necessary to increase public awareness of the importance to reduce food waste behavior. Many people think that throwing away food is not a big problem, thinking that this activity is unavoidable, or because they doubt the quality of the food. Several factors that can affect food waste awareness include: (i) Ease of access and information which can motivate and improve individual abilities in reducing food waste (Fami et al., 2019; Setti et al., 2018). Information about food waste can be a motivation to change food waste behavior and increase environmental awareness (Pelt et al., 2020); (ii) Lack of personal understanding and knowledge about the negative impacts of food waste on health, environment, household economy, society, as well as culture. A person's knowledge of the negative impact of food waste has a significantly positive effect on food waste awareness (Aka & Buyukdag, 2021; Aschemann-Witzel et al., 2021; Attiq et al., 2021; Barone et al., 2019; Koivupuro et al., 2012; Nunkoo et al., 2021; Principato et al., 2015; Schanes et al., 2018).

(2) Determinants of Food Waste Generation

The types of household food waste in each country are different. In the case of European countries, most of food waste in Finland consists of vegetables, cooked home food, and milk (Silvennoinen et al., 2014). Additionally, most of food waste in Hungary and Spain consists of food leftovers, bakery, beef, fish, and animal fat (Szabó-Bódi et al., 2018). In the case of Asia, most household food waste in Hongkong consists of fruits and vegetables (Zan et al., 2018). In terms of determinants of the amount of household food waste, most food waste comes from households, so understanding food waste behavior at the household level will help the prevention efforts. Several previous studies have identified the factors that determine household food waste behavior.

Firstly, in relation to socioeconomic factor, the gender of the head of household (Florkowski et. al, 2018) and the educational level of the head of household (Abeliotis et al., 2016) are the factors affecting the amount of food waste. Old people tend to waste less food

than young people (Lyndhurst et al., 2007), especially retirees with limited financial conditions (Parfitt et al., 2010). Moreover, young families (aged between 25-44 years) and children under 16 are more food wasters (Florkowski et al, 2018; Lyndhurst et al.,2007; McCarthy & Liu, 2017; Parfitt et al., 2010; Schanes et al., 2018). Regarding household size, larger households tend to waste more food (Tucker & Farrelly, 2016; Mattar et al., 2018), but each person in a large family will waste less food than that in a small family (2-3 family members) (Li et al.,2021; Parfitt et al., 2010; Schanes et al.,2018). With respect to rural or urban areas, people in rural areas waste less food than people in urban areas (Lebersorger & Schneider, 2011). Since people living in rural areas are more religious than those in urban areas, they avoid food waste and choose to share food with their neighbors (Mattar et al., 2018). Besides, children's food preferences are different from their parents' which causes more food waste (Priefer et al., 2016). With regard to economic factor, household income is a factor affecting the amount of food waste (Florkowski et al, 2018; Lusk & Ellison, 2017; Setti et al., 2016). People with low income and purchasing power will produce less food waste (Lanfranchi, 2016; Parfitt et al.,2010; Qian et al.,2021).

Secondly, individual habits increase food waste behavior, such as lack of planning or knowledge before shopping, high frequency of buying food, lack of skill in planning types of food to consume, cooking and combining food, excessive cooking at one time, error in serving and storing food, and lack of skill to make new food out of leftovers (Ananda et al., 2021; Bravi et al., 2020; Lanfranchi, 2016; Priefer et al., 2016; Zan et al., 2018). On the other hand, people who list their grocery and carefully plan their food serving will reduce food waste behavior (Diaz-Ruiz et al., 2018). Individual satisfaction with the food consumed can also reduce food waste behavior (Qian et al., 2021). Individuals who desire to save money by not being overspending can reduce food waste (Nunkoo et al., 2021). Furthermore, shopping habits, such as buying food in large quantity or buying products that are not needed, will significantly increase food waste (Aydin & Yildirim, 2021). Purchase in large quantity is usually caused by special offers from sellers (discount or buy one get one free program) and spontaneous buying because of the interest in the product while in store (Bravi et al.,2020; Koivupuro et al.,2012; Nunkoo et al.,2021; Soma et al.,2021). In addition, habit of dine in without good planning and control will increase food waste (Bravi et al.,2020; McCarthy & Liu, 2017; Ponis, et al., 2017). Also, concern about the negative effects of some food on health leads to household food waste (Neff et al., 2015).

Thirdly, regarding product characteristics, product packaging that is too large (cannot be finished in one consumption) increases food waste (Koivupuro et al., 2012; Priefer et al., 2016). Quality packaging is also needed, with the materials, durability, and ideal size that can improve product quality (not easily damaged) (Aka & Buyukdag, 2021). In terms of product shelf life, fresh products with shorter shelf life contribute more to food waste than frozen or preserved products (Lanfranchi, 2016). Bad smell of food, bad physicality of food, and food left on shelf lead to household food waste (Gaiani, et. al., 2017).

The last is related to moral attitude, individuals with high level of moral believe that throwing away food is a mistake and should not be done (Abdelradi, 2018; Aydin & Yildirim, 2021; Barone et al.,2019). The indicators to measure moral attitude are the feeling of shame and guilt when disposing food and the desire to be an excellent example for families with the attitude of appreciating food (Attiq et al., 2021; Mattar et al., 2018; Nunkoo et al., 2021; Yuan et al., 2016). In addition, concerning the negative impacts of food waste on the environment is also a significant factor influencing the habit of wasting food (Riverso et al., 2017). Surprisingly, financial dimension is less important than attitude and feeling dimension (Richter & Bokelmann, 2018). Furthermore, the dimension of social and culture (Hebrok & Boks, 2017) and the dimension of psychology (Schanes et al., 2018) are the factors affecting the amount of household food waste.

(3) Food Waste Management

One part of food waste management at the household level is implementing food consumption management. Households need to apply food consumption management because good management in food preparation and consumption can reduce food waste level (Ananda et al., 2021; Fami et al., 2019). The examples of the application of food consumption management at the household level, involve: (i) planning in food shopping and serving (Martindale, 2014; Schanes et al., 2018), and purchasing frozen food (Martindale, 2014). (ii) improving skills in food storage, freezing, and reprocessing food waste that is still good for consumption (Aka & Buyukdag, 2021; Schanes et al., 2018). In addition, in terms of the campaign to reduce food waste, if consumers return the organic food waste to meat shops, they will get discount on their purchase. This is because organic food waste will be utilized for the next livestock production (Borrello et al., 2017). With respect to the technological science, bio-fertilizer can be produced from food waste (Vich et al., 2017). Also, to reduce the waste of minced beef, its packaging has been developed (Jeznach et al., 2017).

Table 1.1 Summary of Determinants of Household Food Waste Quantity

Demographic and Economic Variables	Literature
Gender of the head of household	Florkowski et al. (2018)
Educational level of the head of household	Abeliotis et al. (2016)
Elderly people	Lyndhurst et al. (2007)
Young families and children in the household	Lyndhurst et al. (2007); Parfitt et al. (2010); Schanes et al. (2018)
Household size	Tucker & Farrelly (2016); Mattar et al. (2018); Li et al. (2021); Parfitt et al. (2010); Schanes et al. (2018)
Rural or urban areas	Lebersorger & Schneider (2011); Mattar et al. (2018)
Household income	Florkowski et al (2018); Lusk & Ellison, (2017); Lanfranchi (2016); Parfitt et al. (2010); Qian et al. (2021); Setti et al. (2016)

Individual Habit Variables	Literature
Lack of planning before shopping, High frequency of buying food, Lack of skill in planning types of food, Cooking and combining food, Excessive cooking at one time, Errors in serving and storing food, Lack of skill to process leftovers into new food	Ananda et al. (2021) Bravi et al. (2020); Lanfranchi (2016); Priefer et al. (2016); Zan et al., (2018)

Shopping Habit	Literature
Buying food in large quantity, Buying products that are not needed, Purchase in large quantity are due to special offers from sellers, Spontaneous buying	Aydin & Yildirim (2021); Bravi et al., (2020); Koivupuro et al. (2012); Nunkoo et al. (2021); Soma et al. (2021).

Product Characteristics	Literature
Product packaging	Koivupuro et al. (2012); Priefer et al. (2016)
Quality packaging	Aka & Buyukdag (2021)
Product shelf life	Gaiani et. al. (2017); Lanfranchi (2016)
Moral Attitude	**Literatures**
Belief that throwing away food is a mistake and should not be done	Abdelradi (2018); Aydin & Yildirim (2021); Barone et al. (2019)
Feeling of shame and guilt	Attiq et al. (2021); Richter & Bokelmann (2018) Mattar et al. (2018); Nunkoo et al., (2021); Yuan et al. (2016)
Concerning the negative impacts of food waste on the environment	Riverso et al. (2017);

1.6 Theory

Theory of Reasoned Action (TRA) was developed by Ajzen and Fishbein. The TRA succinctly states that practice or behavior will be influenced by individual intention, and individual intention is formed from subjective attitude and norms. One of the influencing variables, namely attitude, is influenced by the results of actions that have been carried out in the past. Meanwhile, subjective norms will be influenced by beliefs in the opinions of others and the motivation to obey the beliefs or opinions of others. Simply put, people will take an action if it has a positive value from existing experiences and the actions supported by the individual's environment (Muqqarabin, 2017).

Ajzen expands the theory of reasoned action by adding individual belief and perception of behavioral control, that is the belief that individual can perform a behavior based on their ability to do it, which is called Theory of Planned Behavior (TPB) (Figure 1.1). TPB can be used to predict and explain various behaviors and intentions, such as Food Consumption Management (FCM). According to TPB, behavioral achievement depends on motivation (intention) and ability (controlled behavior). TPB distinguishes three types of belief -

behavioral, normative, and controlled. TPB consists of six constructs that collectively represent a person's actual control over behavior: attitude, subjective norms, social norms, perceived strength, and perceived behavioral control (Lamorte, 2019).

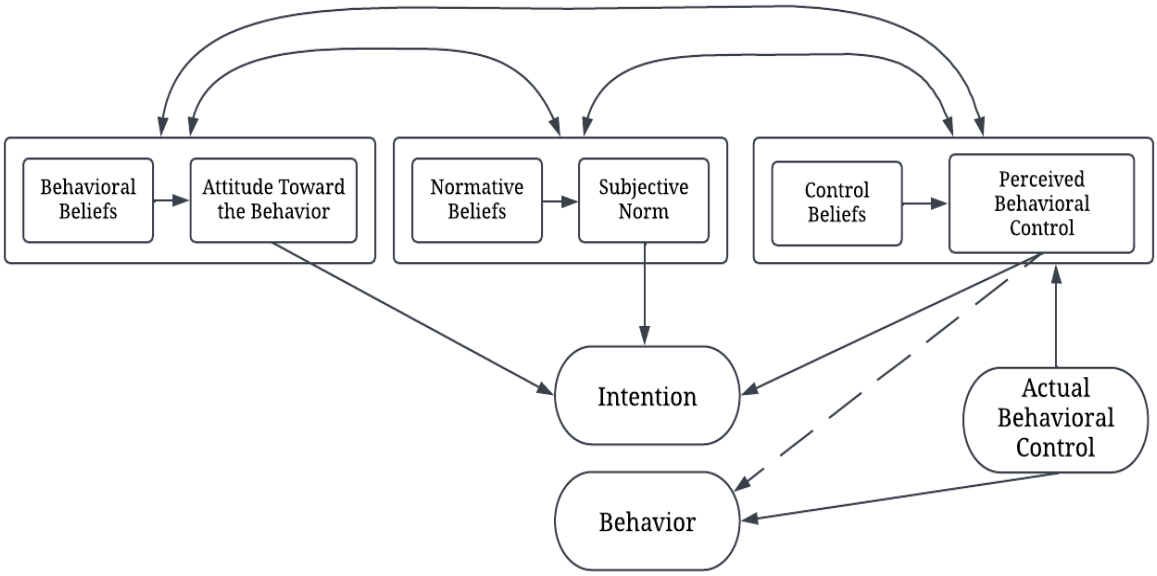


Figure 1.1. Theory of Planned Behavior

Source: Lamorte (2019)

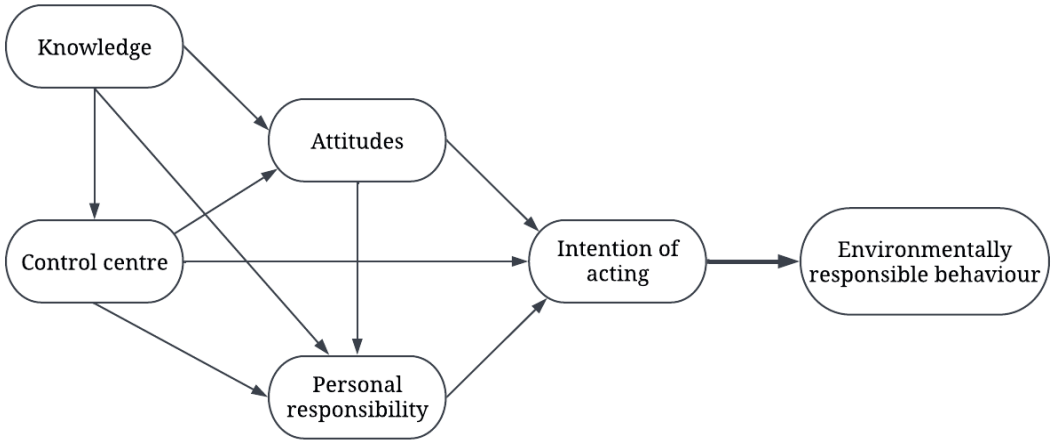


Figure 1.2 Theory of Environmentally Responsible Behavior (ERB)

Source: Akintunde (2017)

Food waste management also relates to Theory of Environmentally Responsible Behavior (ERB). According to Akintunde (2017), ERB theory was proposed by Hines, Hungerford and Tomera, and it was constructed with the intention of acting as a major factor influencing ERB (Figure 1.2). It shows that the following variables - intention to act, locus of control (an internalized sense of personal control over the events in one's own life), attitude, sense of personal responsibility, and knowledge - encourage whether a person would adopt a behavior or not.

1.7 Conceptual Framework

Tracking down the literature review and theory previously perceived, the conceptual framework is outlined in Figure 1.3. It is schematically represented by fours parts: (i) Analysis of food waste awareness of SWU and UGM undergraduate students, (ii) Estimation of the amount of food waste in ten different food groups, (iii) Estimation of Tobit model, and (iv) Analysis of food waste management of SWU and UGM undergraduate students. The parts of awareness and food waste management are based on Theory of Planned Behavior and Theory of Environmentally Responsible Behavior as shown in Figures 1.1 and 1.2, respectively. Meanwhile, the factors affecting food waste generation are derived from literature review as illustrated in Table 1.1.

In the first part, the research findings on FW awareness of undergraduate students will lead to the policy implication to change the consumption behavior of young people so that they become more responsible food consumers and contribute significantly to reducing FW at the household level. Additionally, as the significance of young people in ASEAN, the policy implications to build awareness of the younger generation in understanding well the negative impact of FW and improving their food consumption behavior can be drawn from the research findings in the first part. Moreover, in the second part, the research findings in the estimation of the amount of FW in ten different food groups will be utilized to estimate the value of FW or the value of what their households throw into the rubbish bin. It can be reflected in the inefficiency of their households' consumption spending. Also, the statistical significance of the factors affecting the household FW generation will be revealed in the third part. Hence, the policy recommendations for saving household spending will be drawn. The last part is devoted to FW management of household. It is basically referred to as their food consumption management because the issues consist of planning, providing, preparing, storage of food, and

FW utilization. The analysis results will lead to policy recommendations for food consumption management in household. In sum, the policies made from the four parts of the research findings in the conceptual framework support the achievement of SDG 12 in the part of responsible consumption (Figure 1.3).

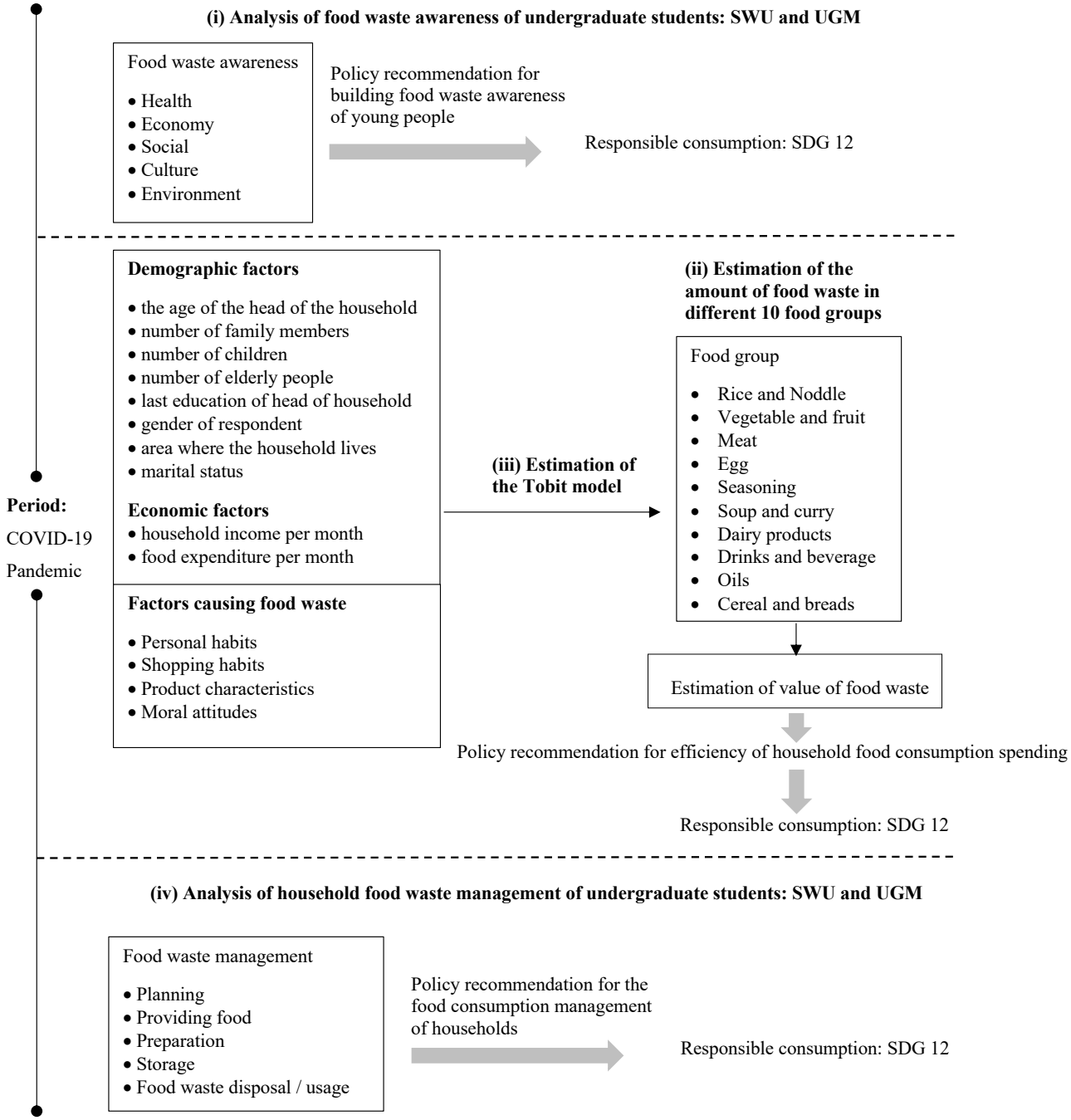


Figure 1.3 Conceptual Framework

1.8 Research Plan

After the inception report has been approved by the ASEAN Centre for Sustainable Development Studies and Dialogue (ACSDSD) committee in the second month of the research plan (May 2022), the secondary data collection and literature study to present the overview of food waste situation in Thailand and Indonesia will be done in the fifth month of the research plan (August 2022). Concurrently, the translation of questionnaire and guide to focus group discussion to receive the ethical clearance certificate at SWU and UGM will be done within two months (September 2022). Afterward, the primary data collection by online questionnaire and FGD / in-depth interview will be conducted in the tenth month of the research plan (January 2023). Descriptive analysis in the case study of UGM households and writing the interim report as well as approval by the ACSDSD Research Scholarship Committee Meeting will be done in the thirteenth month (April 2023). Writing the part of the empirical results and making the concluding remark and policy recommendations will be done in the sixteenth month. The details of activities and the expected outputs of the research plan are presented in Table 1.2.

Table 1.2 Research Plan (Activities and Expected Outputs)

Activities	Year of 2022									Year of 2023							Researcher	Expected output
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7		
• Revise the research proposal. • Add more the literatures. • Design draft of questionnaire • Writing the inception report and approving by the ACSDSD Research Scholarship Committee Meeting	←	→															Jirawat, Hani and Jangkung	• Inception report consists of two Chapters with Appendix a. • Chapter 1 Introduction and Chapter 2 Research methodology • Appendix a. Questionnaire
• Collect the secondary data in Thailand and SWU • Survey literatures of food waste in Thailand			←		→												Jirawat	• Secondary data in Thailand and SWU • Overview of FW situation in Thailand

Activities	Year of 2022									Year of 2023							Researcher	Expected output
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7		
• Collect the secondary data in Indonesia and UGM • Survey literatures of food waste in Indonesia			←	—	→												Hani and Jangkung	• Secondary data in Indonesia and UGM • Overview of FW situation in Indonesia
• Translate the questionnaire to Thai and Bahasa Indonesia as well as adjust it to the Google Form • Design guide to focus group discussion (FGD) / In-depth interview				←	→												Jirawat, Hani and Jangkung	• Draft Questionnaire in Thai and Bahasa • Google form of Questionnaire in Thai and Bahasa • Guide to FGD / In-depth interview
• Submit research proposals for ethics review (SWU and UGM)					←	→											Jirawat, Hani and Jangkung	• Ethical Clearance Certificate • Informed Consent Form • Information Sheet for Research Participant
• Pilot testing for each country (Thai and Indonesia) • Final version of questionnaire						←	→											• Final version of questionnaire
• Survey design (Briefing the questionnaire for respondent (students) in two parts. First, the question related for themselves. Second, question for their parents.						←	→										Jirawat, Hani and Jangkung	• Procedure of collecting primary data
• Data collection (Online questionnaire) in case study of SWU household student sample • Coding and recording in Excel. • Focus Group Discussion / In-depth interviews								←	—	→							Jirawat	• Excel database file in case study of SWU household student sample

Activities	Year of 2022									Year of 2023							Researcher	Expected output
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7		
• Data collection (Online questionnaire) in case study of UGM household student sample • Coding and recording in Excel. • Focus Group Discussion								←	→								Hani and Jangkung	• Excel database file in case study of SWU household student sample
• Descriptive analysis in case study of SWU household student sample										←	→	→					Jirawat	• Preliminary results
• Descriptive analysis in case study of UGM household student sample										←	→	→					Hani and Jangkung	• Preliminary results
• Writing the interim report and approval by the ACSDSD Research Scholarship Committee Meeting											←	→	→				Jirawat, Hani and Jangkung	• Interim report consists of four chapters (Chapter 1 Introduction, Chapter 2 Research methodology, Chapter 3 Food waste situation in Thailand and Indonesia), and Chapter 4 Preliminary results. • Appendices consist of Draft questionnaire, Guide to FGD/ In-depth interviews, and Ethical Clearance Certificate.
• Statistical analysis • Tobit model estimation (SWU)													←	→	→		Jirawat	• Empirical results in case of SWU
• Statistical analysis • Tobit model estimation (UGM)													←	→	→		Hani and Jangkung	• Empirical results in case of UGM

Activities	Year of 2022									Year of 2023							Researcher	Expected output
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7		
• Writing the part of the empirical results (SWU): -Food waste awareness - Determinants of the amount of household food waste - Food waste management • Writing the part of Statistical comparison of two groups • Drawing the concluding remark and policy recommendations • English proof reading															←	→	Jirawat	• Final report (Chapter 1 to Chapter 5) • Abstract in Thai and in English

Chapter 2

Research Methodology

2.1 Population and Sample

The population of this research is the households of SWU and UGM undergraduate students from various study programs as many as 22,478 and 32,111 respectively. The students were grouped into two clusters, namely sciences and social sciences & humanities (Table 2.1). This research was conducted by stratified random sampling (Taherdoost, 2016) using Slovin method (Adam, 2020) making up the sample of this study amounting 394 SWU student households (sciences: 216 and social sciences & humanities: 178) and 396 UGM student households (sciences: 263 and social sciences & humanities: 133). More specifically, the sample was divided into two groups: the first group was the heads of households who were mainly in charge of food consumption at home or the wife of the head of household, and the second group was the students. The first sample group was for research questions number (ii) to (iv), and the second one was intended for research question number (i). In total the number of students together with their father/mother made up 788 and 792 observations for SWU and UGM respectively.

Table 2.1 Population and Sample Size

a. Srinakharinwirot University, the academic year of 2019

Faculty	Number of students	Population	Sample
Branches of Sciences			
Faculty of Dentistry	382		
Faculty of Pharmacy	497		
Faculty of Physical Therapy	446		
Faculty of Agricultural Product Innovation for Sustainability	594	**9,517**	**216**

Faculty	Number of students	Population	Sample
Faculty of Sciences	1,980		
Faculty of Nursing	459		
Faculty of Medicine	1,150		
Faculty of Engineering	1,749		
Faculty of Physical Education	1,959		
College of Creative Industry	133		
Bodhivijjalaya College	168		
Branches of Social Sciences and Humanities			
Faculty of Humanities	3,034		
Faculty of Social Sciences	3,032		
Faculty of Education	846		
Faculty of Fine Arts	1,618		
Faculty of Environmental Culture and Ecotourism	474	**12,961**	**178**
Faculty of Economics	789		
College of Social Communication Innovation	1,494		
International College for Sustainability Studies	611		
Faculty of Social Business Administration	1,063		
Total		**22,478**	**394**

b. Gadjah Mada University, the academic year of 2021

Study Program	Number of students	Population	Sample
Branches of Sciences			
Agriculture	2,250		
Livestock	1,317		
Geography	1,134		
Pharmacy	893		
Biology	1002		
Dentistry	816		
Veterinary Medicine	834	**21,366**	**263**
Medical	1,798		
Forestry	1278		
Mathematics and Science	2,888		
Engineering	5,790		
Agriculture Technology	1,366		
Branches of Social Science and Humanities			
Economy and Business	2,155		
Philosophy	741		
Law	1,748		
Culture Science	2,465	**10,745**	**133**
Sociology	2,513		
Psychology	1,123		
Total		**32,111**	**396**

2.2 Structure of Questionnaire

The more detailed questionnaire can be seen in Appendix A which consists of three main aspects, namely:

(1) Students food waste awareness (for student): This variable was composed by six aspects: (i) Perception of FW reduction consequences and its practical benefits, (ii) Health awareness, (iii) Economic awareness, (iv) Social and cultural awareness and FW guilt, (v) Environmental awareness, and (vi) FW reduction potential.

(2) Food waste household behavior (for the head of household who is mainly in charge of food consumption at home or the wife of the head of household): The indicators were food waste data and the influencing factors including social, economic, and demographic data, personal habits, shopping habits, product characteristics, and moral attitude. Moreover, the questions about food in their households, the composition and amount of breakfast, lunch, dinner, and snacks were given to the respondents before the questions of 24-hour dietary recall related to food waste in the household. In addition, based on Van Herpen et al. (2019), food waste was grouped into four categories, encompassing:

- Completely unused foods: foods that are disposed without being used at all
- Partly used foods: foods that are disposed after partly used
- Meal leftovers: leftovers that are disposed after being left on plate, pot, pan, or bowl.
- Leftovers after storing meals: leftovers that are disposed after being stored in the fridge or freezer to eat at a later time.

(3) Food consumption management (for the head of household who is mainly in charge of food consumption at home or the wife of the head of household): Management carried out by households starting from planning, provision, preparation, serving/processing, storage, and food waste disposal/utilization.

2.3 Method and Procedure

After the research proposal, the questionnaire, and the documents of Focus Group Discussions (FGD) / in-depth interview were approved by the research ethics committee in

SWU and UGM, 30 samples (14 from SWU and 15 from UGM) were invited for pretest procedure of the questionnaire. The documents from the research ethics committee approval are attached in Appendix B. Then, the questionnaire validity and reliability were analyzed using Pearson correlation test (Babucea, 2007) and Cronbach's Alpha (Bonett & Wright, 2015), respectively. Because of the small sample size, some indicators and variables failed to reject the null hypothesis in the validity and reliability tests. After the statements in those indicators and variables in Part II and Part III were edited, all indicators and variables with 440 samples were able to reject the null hypothesis in the validity and reliability test at a 10% statistical significance level. More detailed results of the validity and reliability tests are presented in Appendix C. The structure of the questionnaire in Part II was edited according to the responses at the pretest stage.

The research team sent the online questionnaires to the students and briefed them so as to have the same perception about the questionnaire. As previously mentioned, the students answered the questionnaire in part I. They also interviewed the heads of households who were mainly in charge of food consumption at home or the wives of the heads of households with the questions in parts II and III of the questionnaire. After the questionnaire was sent to the respondents, a reminder and monitoring was carried out periodically to complete the number of respondents. Data collection was also carried out through FGD / in-depth interview to deepen the study of this research. The guide to FGD / in-depth interview can be seen in Appendix D.

Table 2.2 Interpretation of Scores

Average score	Category
4.1 - 5.0	Strongly Agree (Excellence)
3.1 - 4.0	Agree (Very good)
2.1 - 3.0	Neutral (Good)
1.1 - 2.0	Disagree (Fair)
0.0 - 1.0	Strongly Disagree (Poor)

Data analysis was separated into four parts to attain four objectives of the research as follows: First part was food waste awareness which was analyzed by the statements using Likert scale (where 1 = Strongly Disagree and 5 = Strongly Agree) searching the answers

related to personal understanding and awareness of the impact of food waste on health, environment, household economy, society, and culture. Furthermore, the interpretation of the average score is presented in Table 2.2. In data analysis, descriptive statistics including mean and standard deviation was applied in the case of SWU and UGM. Then, the analysis results were compared between UGM and SWU using Z test. The null (H_0) and alternative (H_1) hypotheses are as follows:

$$H_0: \mu_i^{SWU} - \mu_i^{UGM} = 0,$$

$$H_1: \mu_i^{SWU} - \mu_i^{UGM} \neq 0,$$

where *i* represents the indicators/variables

In the second part, the data on the amount of household food waste were estimated. The data were derived from generating household food waste within one day due to the budget limitation and limited time of our research project. There were ten categories of 24-hour recall of food waste in the households of SWU and UGM undergraduate students, namely Rice and Noodles, Vegetables and Fruits, Meat, Egg, Seasoning, Soup and Curry, Dairy products, Drinks and Beverages, Oils, and Cereal and Bread. The food waste was also grouped into four categories, namely Completely Unused Foods, Partly Used Foods, Meal Leftovers, and Leftovers after storing meals. In terms of data analysis, descriptive statistics including percentage and mean was employed, and the amount of food waste (gram(ml)/household/day) and its amount per capita per year would be estimated. The procedures of the estimation of the value of food waste in the households of SWU and UGM undergraduate students are as follows:

(1) The average value of the amount of FW in one day was estimated and assumed that each household generated the same amount of FW every day.

(2) According to the official announcement of the Department of Corrections, the food waste auction price of the prison at Thanyaburi District, Pathum Thani Province would be used as the estimation of FW value of SWU amounting 324.50 THB per 100 liters in the fiscal year of 2023. However, due to the limitation of such data in Indonesia, the price in Thailand was used as a proxy of FW price of UGM, which was 139,200 IDR per 100 liters. In addition, the Bank of Thailand's reference exchange rate in the first quarter of 2023 (33.9120 THB/USD) and the Bank of Indonesia's reference in the first quarter of 2023 (10,382.10 IDR/USD) were used for the estimation of the FW value in terms of USD.

(3) Under the assumption of homogeneous households in the populations of SWU and UGM, the estimated FW value per year in each household was used as the estimation of the FW value of 22,478 and 32,111 households of SWU and UGM undergraduate students respectively.

Next, to find out the factors that influence the amount of food waste an analysis using Tobit model (Smith & Brame, 2003) was conducted, which is presented in the next section. The independent variables consist of quantity and quality variables. The first type of variables includes household income per month, food expenditure per month, number of family members, number of children, number of elderly people, and educational level of the head of the household. Meanwhile, the second type of variables is divided into two subtypes. The first sub-type of variables is in the form of dummy variables including area of the household and marital status. The second sub-type of variables is derived from the statements employing Likert scale (1-5) related to personal habits, shopping habits, product characteristics, and moral attitude. Spector (1992) briefly states that in order to utilize those variables as the independent variables, Likert scale is a summated ranking scale. The example of the calculation is as follows.

Since twelve statements are contained in the personal habits variable as seen in the questionnaire, it can be implied that this variable has sixty scores. Then, each scale (1, 2, 3, 4, and 5) derived from the answer to each statement from all respondents is transformed into the z-score. The details of the formula can be found in Azwar (2017). Thus, the transformation of the scale into score will be applied for each answer to the statement from the respondents. Afterward, when the z-score of twelve statements of the respondents is summed, its summation means the score of personal habits variable of the respondents out of the full score of sixty. The score is revealed to record as a value of an independent variable of the observation. As a consequence, the personal habits variable looks very similar to the form of a quantitative variable. It is also ready to use for running the regression model.

The last part will analyze food consumption management. It can reflect food waste management. We measure the statements using 5-point Likert scale (where 1 = Strongly Disagree and 5 = Strongly Agree) which are related to planning, providing food, preparation, serving/processing, storage, and food waste disposal/utilization (Ananda et al., 2021; Fami et al., 2019). Furthermore, the interpretation of the average score is presented in Table 2.2. The descriptive statistics which consists of mean and standard deviation were applied in the case of

SWU and UGM analysis. Then, the analysis results between UGM and SWU were compared using Z test. The null (H_0) and alternative (H_1) hypotheses are as follows:

$$H_0: \mu_i^{SWU} - \mu_i^{UGM} = 0,$$

$$H_1: \mu_i^{SWU} - \mu_i^{UGM} \neq 0,$$

where *i* represented the indicators/variables.

2.4 Tobit Model

To analyze the third objective, namely factors causing household food waste of SWU and UGM undergraduate students, Tobit model was used. This is because the dependent variable, the amount of food waste, was limited to 0 (Figure 1.3). Thus, Tobit model was estimated using the maximum likelihood method as suggested by Gujarati and Porter (2009), and Smith and Brame (2003). The model for each food group proposed in this research is as follows:

$$\begin{aligned} \text{FWaste} = {} & \alpha + \beta_1\text{Age} + \beta_2\text{Income} + \beta_3\text{Expend} + \beta_4\text{Number} + \beta_5\text{Child} \\ & + \beta_6\,\text{Elder} + \beta_7\,\text{Edu} + \beta_8\text{Gender\_D1} + \beta_9\,\text{Area\_D1} + \beta_{10}\,\text{Status\_D1} \\ & + \beta_{11}\text{PersHabit} + \beta_{12}\,\text{ShopHabit} + \beta_{13}\text{ProdCharac} + \beta_{14}\text{Attitude} + \varepsilon, \end{aligned}$$

where FWaste = max(FWaste*, 0),

FWaste* : the amount of food waste disposed by households,

Age : the age of the head of household (unit: years),

Income : household income per month (unit: local currency unit per month),

Expend : food expenditure per month (unit: local currency unit per month),

FamMember : number of family members (unit: persons),

Child : number of children (unit: persons),

Elder : number of elderly people (unit: persons),

Edu : last education of the head of household (unit: years),

Gender_D1 : gender of the respondent (1 = female and 0 = male),

Area_D1 : area of household resides (1 = urban and 0 = rural),

Status : marital status (1 = single and 0 = married / widow),

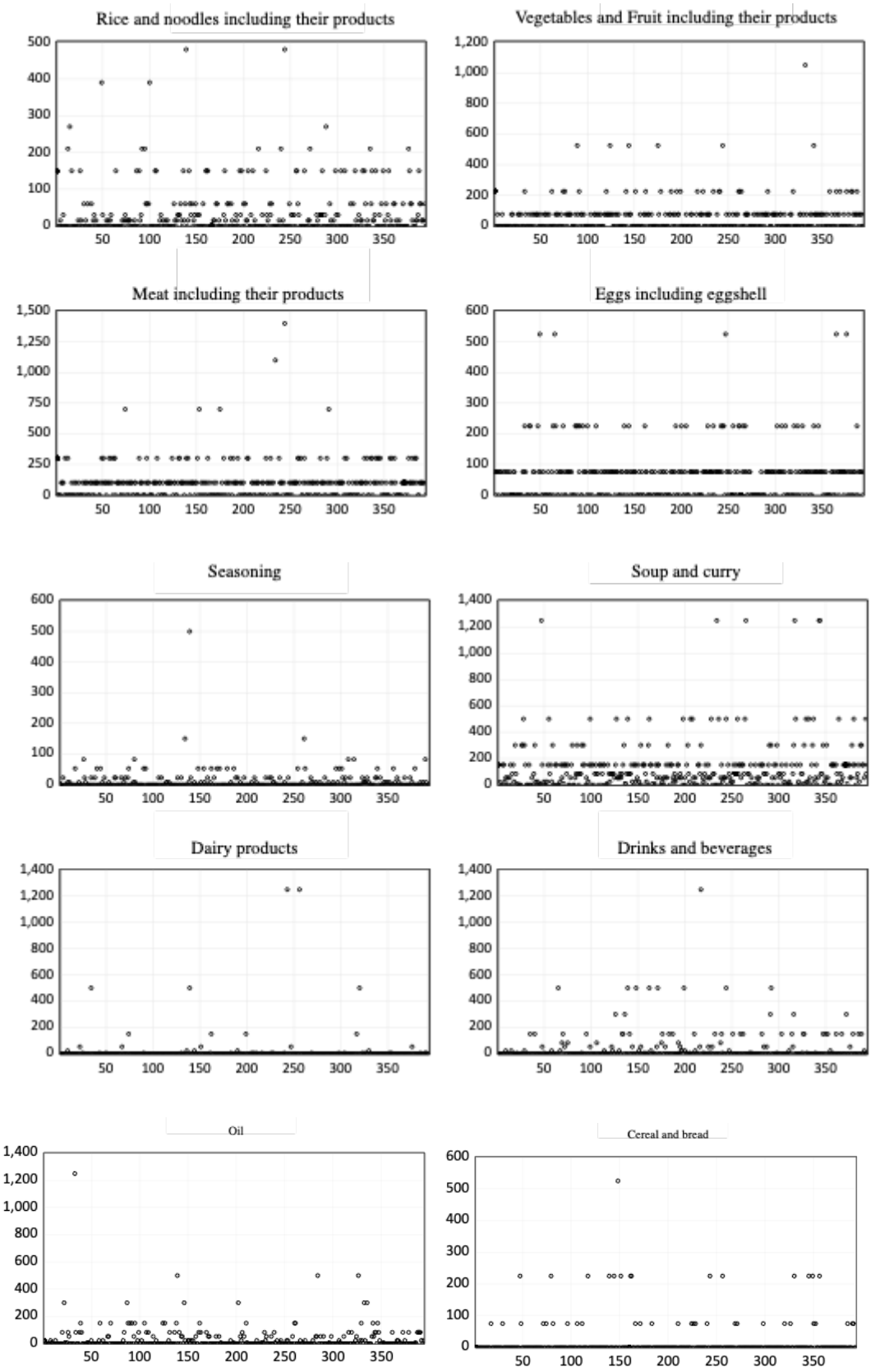
PersHabit : personal habit (as a z-score),

ShopHabit : shopping habit (as a z-score),

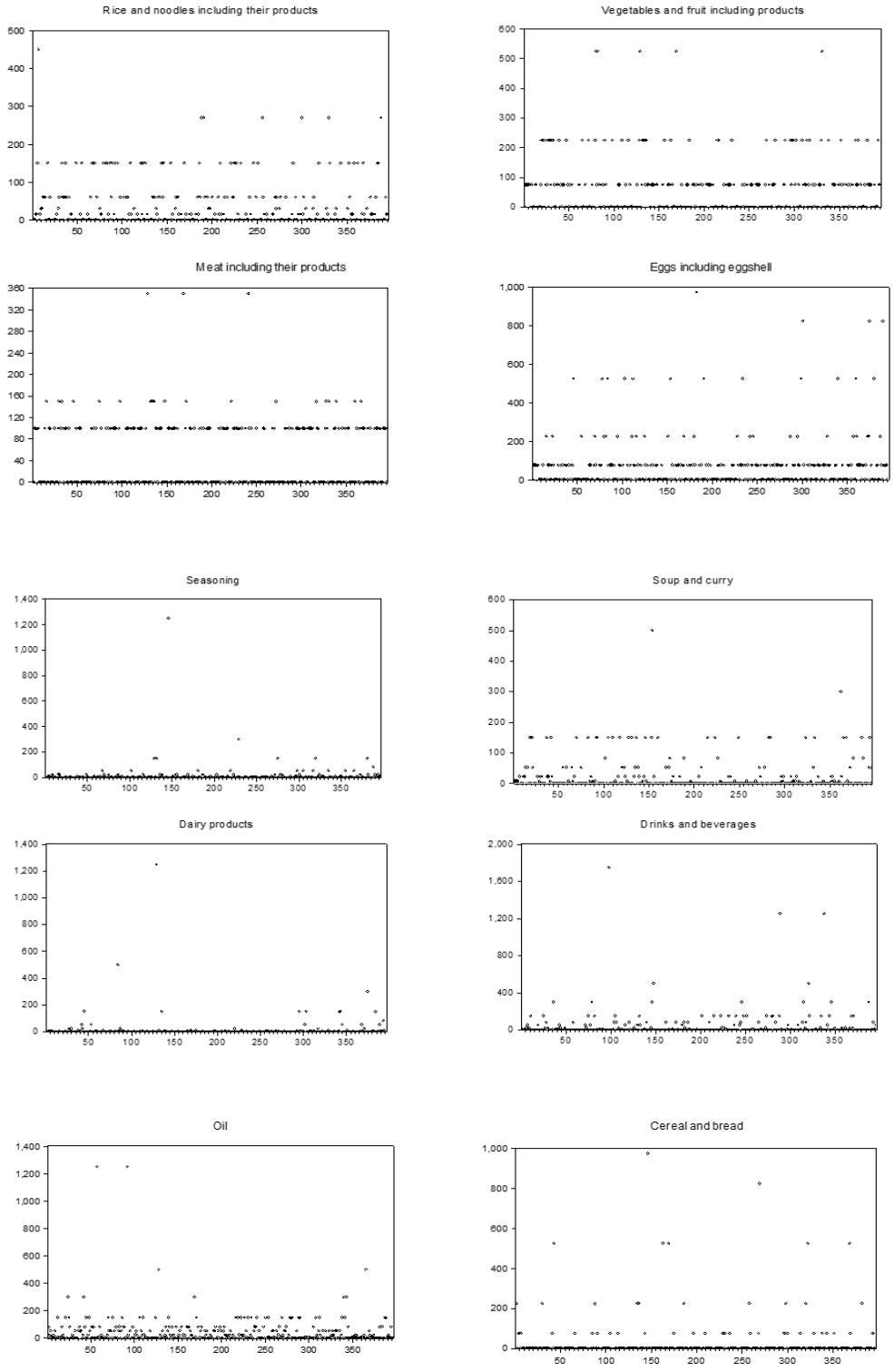
ProdCharac : product characteristics (as a z-score),

Attitude : moral attitude (as a z-score),

ε : disturbance terms, which is IID (Independent Identically Distributed)



a. Value of Dependent Variables in the Case of SWU



b. Value of Dependent Variables in the Case of UGM

Figure 2.1 Value of Dependent Variables in the Case of SWU and UGM

Chapter 3

Food Waste Situation in Thailand and Indonesia

3.1 Overview on Food Waste Situation in Thailand: Survey of Literature

Based on the data of the Pollution Control Department, over the past five years, the average quantity of solid waste in Thailand was about 73,621.92 tons per day. Its year-on-year growth increases from 1.15% in 2017 to 2.79% in 2019. Afterward, the quantity of solid waste decreased in 2020 and 2021. Especially in 2020, its year-on-year growth was about -11.63%. Unsurprisingly, Bangkok province as the capital city of Thailand has generated solid waste with the highest proportion up to present. The other significant provinces contributing food waste are Samut Prakan, Chonburi, Nakhon Ratchasima, and Chiang Mai (Table 3.1).

Table 3.1 Solid waste in Thailand and the Selected Provinces from 2017 to 2021 (Unit: Tons per day)

Year	Thailand	Bangkok province	Samut Prakan province	Chonburi province	Nakhon Ratchasima province	Chiang Mai province
2017	74,986.30 (1.15%)	13,327.00 (15.59%)	2,445.00 (3.50%)	2,547.00 (-2.78%)	2,458.00 (-0.01%)	1,669.00 (0.63%)
2018	76,520.55 (2.05%)	13,240.49 (-0.65%)	2,449.77 (0.20%)	2,591.03 (1.73%)	2,480.07 (0.90%)	1,655.31 (-0.82%)
2019	78,657.53 (2.79%)	13,583.48 (2.59%)	2,362.24 (-3.57%)	2,909.86 (12.31%)	2,511.25 (1.26%)	1,647.86 (-0.45%)
2020	69,506.85 (-11.63%)	12,281.70 (-9.58%)	2,341.50 (-0.88%)	2,683.70 (-7.77%	2,337.30 (-6.93%)	1,434.40 (-12.95%)
2021	68,438.36 (-1.54%)	12,214.00 (-0.55%)	2,515.00 (7.41%)	2,750.00 (2.47%)	2,271.00 (-2.84%)	1,415.00 (-1.35%)
Average	**73,621.92 (-1.44%)**	**12,929.33 (1.48%)**	**2,422.70 (1.33%)**	**2,696.32 (1.19%)**	**2,411.52 (-1.52%)**	**1,564.31 (-2.99%)**

Note: The number in parenthesis means year-over-year growth.

Source: Pollution Control Department, Ministry of Natural Resources and Environment

As for the data on food waste, the official data in Thailand have not been precisely reported. The Pollution Control Department provided only the data on organic waste (TDRI, 2019). Therefore, we summarize the previous literature to illustrate the overall food waste situation in Thailand. The ratio of food waste to solid waste in Bangkok increased from 31% in 2003 to 48% in 2016 (Table 3.2). Furthermore, Liu et al. (2020) found that Bangkok's food waste generation doubled from 2,860 tonnes per day in 2003 to 5,669 tonnes per day in 2018. The proportion of food waste in municipal solid waste was 53% in 2018, which was rising since 2015. The food waste per capita was estimated to be 0.38 – 0.61 kilogram per day in 2018, which is high even compared to the developed cities.

Table 3.2 Municipal Solid Waste in Bangkok (Unit: Tons per day) and Percentage of Food Waste in Municipal Solid Waste from 2003 to 2018

Year	Solid Waste	Food Waste	Year	Solid Waste	Food Waste
2003	9,350 (-)	31%	2011	8,943 (2.02%)	45%
2004	9,357 (0.07%)	35%	2012	9,748 (9.00%)	43%
2005	8,496 (-9.20%)	45%	2013	9,963 (2.21%)	43%
2006	8,377 (-1.40%)	45%	2014	9,940 (-0.23%)	42%
2007	8,719 (4.08%)	42%	2015	10,167 (2.28%)	43%
2008	8,780 (0.70%)	42%	2016	10,130 (-0.36%)	48%
2009	8,788 (0.09%)	44%	2017	10,526 (3.91%)	52%
2010	8,766 (-0.25%)	48%	2018	10,705 (1.70%)	53%

Note: The number in parenthesis means the year-over-year growth.

Source: Bunditsakulchai and Liu (2021)

In the case of Chonburi province, which is a beach city of tourists, the Provincial Administrative Organization (PAO) and Pattaya Municipality have not had an exact campaign

to sort organic waste from solid waste. In terms of waste sorting, they have not provided the categorization of different types of rubbish. Hence, the restaurants and hotels do not sort the waste before throwing it into the rubbish bin, so the official data on food waste has not been excluded from solid waste. On the other hand, Nakhon Ratchasima province, which is an economic city in the northeast, the Municipality has encouraged waste sorting for household. With respect to waste management, the typical recyclable waste, including glass bottles, plastics, and paper can be sold to earn money for households. Organic waste, including vegetable and fruit waste, can also be the material for organic fertilizer. If households do not have enough area to make fertilizer, the Chief Executive of Subdistrict Administrative Organization (SAO), the subdistrict headman, and the village headman will provide the area to dispose their food waste. Afterward, the food waste is collected to make organic fertilizer for the community or consigned to PAO to be utilized in biogas power plant or ends up in landfills. In the case of Chiang Mai province, which is a famous city of tourists, the PAO hires a private company to manage solid waste. The waste further end up in landfills to produce water for bio-energy. Hence, most households, restaurants, and hotels lack of motivation to sort the solid waste before disposal, so the official data on food waste has not yet been excluded from those of solid waste (TDRI, September 2019).

(1) Determinants of Food Waste Generation

Food waste is basically generated at the retail and consumer level in the supply chain of food products. At the retail level, the mathematical modeling of two-level supply chain reveals that package size strongly affects the reduction of the amount of total food waste in the supply chain. In addition, the inventory managers should focus on extending shelf life, particularly for the products that usually last only one day to make them last at least two days by providing better storage conditions. This should be done because the percentage of reduction of food waste for this time frame is much higher than for other time frames (Somkun, 2020). More specifically, with respect to the supply chain for Chinese cabbage, the quality requirements are often accompanied by food loss and waste generation and propagated upstream of the chain. The stakeholders associated with modern retailers produce on average significantly more waste from trimming (42%) than other stakeholders that are less tied to cosmetic standards (18-24%) (Ortiz-Gonzalo et al., 2021).

At the consumer level, consumers wasted edible food of around 19 grams per meal at three main canteens of the university. The generation of plate waste is affected by the food

provision system, including the canteen setting, food purchasing procedure, and food quality (Thongplew et al., 2021). Currently, the amount of household plastic and food waste in Bangkok has risen since the COVID-19 pandemic. The shift from eating out to online food delivery service causes rise in the number of plastic bags, hot-and-cold food bags, plastic food containers, as well as food waste. The determinants of household plastic and food waste are excessive amount of food, food which is not appetizing in appearance, aroma, or taste, followed by expired food, and rotting/foul odors. It may be the results of the inability to predict the quantity and quality when ordering online, and inadequate food planning and management by consumers (Liu et. al., 2021). Meanwhile, in the case of Bangkok and five nearby provinces: Nonthaburi, Pathumthani, Samut Songkram, Samut Prakarn, and Nakorn Pathom, the results of the survey show that the Covid-19 lockdown has an impact on the increasing number of used surgical masks and recyclable waste; nonetheless, food waste has not been affected (Srijuntrapun & Chaiboonchoe, 2021)

In addition, based on the log-linear regression method, the factors affecting the frequency of throwing foods or ingredients away before trying them are as follows. The first one explains the relationship between the frequency of checking foods or ingredients in the refrigerator before going shopping and the frequency of throwing foods or ingredients away before trying them even once. Checking foods or ingredients in the refrigerator before going shopping tends to reduce how often foods or ingredients are thrown away before trying them even once by 10.3%. The second one is the frequency of making leftovers when eating out. The reduction in the frequency of making leftovers when eating out reduces how often foods/ingredients are thrown away before trying them by 32.6%. Surprisingly, most socio-economic factors are not statistically significant (Bunditsakulchai & Liu, 2021). Apart from this, the food waste quantity in Kaeng Krachan National Park in Thailand is correlated with the number of tourists, species number, total number of individual animals, and species abundance (Teampanpong, 2021).

(2) Food Waste Management

The mechanism of solid waste management is basically driven by the government and private sector, particularly at the household level. Food waste management at the fresh market, more specifically related to cabbage and lettuce waste, is performed by private sector to be collected for fertilizer production and animal feed. Furthermore, the physical and chemical characteristics of food waste in this market enable the high potential of utilization and are

acceptable by the soil quality standards for heavy metal contamination. Fertilizer, biogas, and refuse-derived fuel productions are a strong ability of utilization of food waste management in large vegetable markets by brainstorming with the market owners, shop owners, and a research team (Ounsaneha et al., 2019).

At the household level, the Department of Environmental Quality Promotion (2018) reported that 10.16% to 73.27% of people never used waste management according to the 3R (Reduce, Reuse, Recycle) waste management initiative. Only 10.16% of people who never sold, donated, or exchanged the recycled wastes, and 39.99% never used food waste for making compost. In addition, 73.27% never used food waste for making bio-extract and biogas. As the policy recommends, the government should encourage the private sector, including households, communities, and educational institutions to realize solid waste management, particularly by instilling solid waste awareness in people from the kindergarten level and giving more chance for new generations to be the trainers for waste management. In addition, in terms of Greening a campus, Tangwanichagapong et al. (2017) found that the 3R waste management initiative had positive effects on people's attitudes about resources, waste management, and consciousness of the need to avoid waste, but this initiative did not affect recycling and waste management behavior.

In terms of Recycle (3R principle), there are some scientific research that investigates the recycling of food waste such as eggshell waste for ceramic property improvement (Sangmala et. al., 2021), biogas production from food waste, and vegetable waste for the Sakaew Temple Community in Angthong Province (Hussaro et. al., 2017), and life cycle environmental and economic analysis of regional-scale food-waste biogas production with digestate nutrient management for fig fertilization. The economic analysis shows that food waste disposal income and electricity sales are hot spots in the revenue, and interest payment and maintenance cost have high impact on expenditure. The most sensitive parameter is biomethane yield, which should be kept higher for the profitable operation of the biogas plant in Thailand (Koido et. al., 2018).

Waste management behavior at the community or household level in the cases of the provinces in the northern region involves Nan Province (Maruean et al., 2013), Lamphun Province (U-chupaj, 2018), and Phitsanulok Province (Khongpirun et al., 2017; Thabpadung, 2020). Also, the case of provinces in the northeastern region includes Bueng Kan Province (Sriyothee, 2020) and Mahasarakham Province (Khaeongmueang, 2019). Meanwhile, the case

of provinces in the central and southern regions comprises Samut Songkram Province (Jeamponk, 2012) and Nakhon Si Thammarat (Kirdklinhom, 2019). As the main result, most respondents have moderate to high knowledge of waste management. The details of each province are presented in Table 3.3.

Table 3.3 Summary of Waste Management Behavior in the Selected Provinces of Thailand

Area	Main Results	Authors
The cases of the northern region		
Paklang Subdistrict, Pua District, Nan Province	A model of the waste management of hill tribe communities comprises (i) Analysis of the problems and the potentials of the community, (ii) Competencies of community leaders, (iii) Bringing the project into compliance, and (iv) Evaluation. As a result, the community has an attitude and habit adjustment to the correct waste management and continuously makes other creative activities. Therefore, the waste has been reduced by 39.37%.	Maruean *et al*. (2013)
Laoyao Subdistrict administrative organization, Ban Hong District, Lamphun province	The knowledge of waste management is at a moderate level (48.61%). The knowledge of the types of degradable waste is at the highest level (95.44%), followed by the reduction of waste by using food containers instead of foam boxes (93.42%).	U-chupaj (2018)
Mueang District, Phitsanulok Province	The household solid waste reduction behavior is at a high level ($\bar{x}$ = 3.89).	Thabpadung (2020)
Kaeng Sopha Subdistrict, Wang Thong District, Phitsanulok Province	Although most volunteers had high level of knowledge (60.83%) and awareness (90.08%) of waste management, the behavior of waste management was at a moderate level (67.77%).	Khongpirun (2017)
The cases of the northeastern region		
Seka District, Bueng Kan Province	Waste management knowledge of the people was at the highest level, namely 82%. Also, people participation in waste management was at a moderate level ($\bar{x}$ = 3.21). As a whole, their value of attitude toward waste management was high ($\bar{x}$ = 4.14). Contemplating the people's waste management behavior, it was found that their overall behavior was at a high level as well ($\bar{x}$ = 3.57).	Sriyothee (2020)

Area	Main Results	Authors
Wangsaeng Sub-District, Kaedam District, Mahasarakham Province	The overall household solid waste management of the people was at a high level.	Khaeongmueang (2019)
The cases of the central region		
Suanluang Sub-District, Amphawa District, Samut Songkram Province.	92.8% of the households made several attempts to reduce their own amount of waste, by reusing products before disposal, using fabric bags instead of plastic ones, and replacing chemical fertilizer with organic fertilizer. 81.6% stationed their own garbage bins. 85.3% managed and utilized their waste by selling recyclable products or turning their garbage into organic fertilizer.	Jeamponk (2012)
The cases of the southern region		
Nakhon Si Thammarat Municipality	Statistically, the level of public participation in household waste management in this city was "medium". The level of involvement for benefit was "high". In contrast, the level of involvement in decision-making and evaluation was "low".	Kirdklinhom (2019)

Regarding the government sector, Rado (2022) revealed that in 2016, Thailand instituted a national master plan to gradually improve the management of all types of solid waste, calling upon the cooperation of diverse stakeholders, including civil society. Accordingly, in the case of the municipality north of Bangkok, there are recommendations to increase the effectiveness of food waste recovery, namely arguing for a stronger focus on household-level waste reduction strategies. In addition, Thailand Environment Institute (2021) suggests that Bangkok Metropolitan Administration (BMA) applies the "Nudge Theory" which is in line with Behavioral Economics to adjust the household behavior without force. Additionally, See-mook (2021) proposes that the government should apply tax measurement for food waste reduction. The policy is to encourage the utilization of food waste that is generated at the entrepreneur level. However, Vanapruk (2011) found that the causes of the failure in solid waste management in the urban areas in Thailand involved: (i) a lack of credible information on waste management to formulate targets and implementation plans; (ii) a lack of understanding of the crux of the waste management policy of related authorities, especially

local authorities' implementation plans, and inefficiency of implementation by related authorities as well as local authorities; (iii) inadequate resources to implement the policy such as fiscal budget and specialists.

In addition, the public-private partnerships scheme (PPP) has been proposed because waste-to-energy technology requires high investment and expertise to operate the plants. The private investors utilize their own expertise to build the plants and gain revenue in return by the selling of electricity and the tipping fee. The government will change its role from the operator to the regulator to supervise and control the operation of the plants. The incentives such as tax exemption and Feed-in Tariff schemes are provided to help investors mitigate investment risks resulting from the inconsistent nature of renewable energy sources (Laohalidanond & Kerdsuwan, 2021).

Instead of recycling food waste with the mega project, the conceptual model of household food consumption behavior has been proposed. Furthermore, the paradigm of household food waste reduction embraces the principle of pre-hoc food waste management with a focus on households that require low budget. In other words, the conceptual framework is based on food management along with daily food consumption activities and targets low-budget household food waste prevention. Households can integrate the method into their daily lives. The conceptual model of food waste reduction consists of seven stages: Pre-shopping planning, Shopping, Storage and preservation, Cooking, Eating habits, Processing of leftovers, and Food waste recycling. (Srijuntrapun, 2016; Bunditsakulchai & Liu, 2021). The details of the model are illustrated in Figure 3.1.

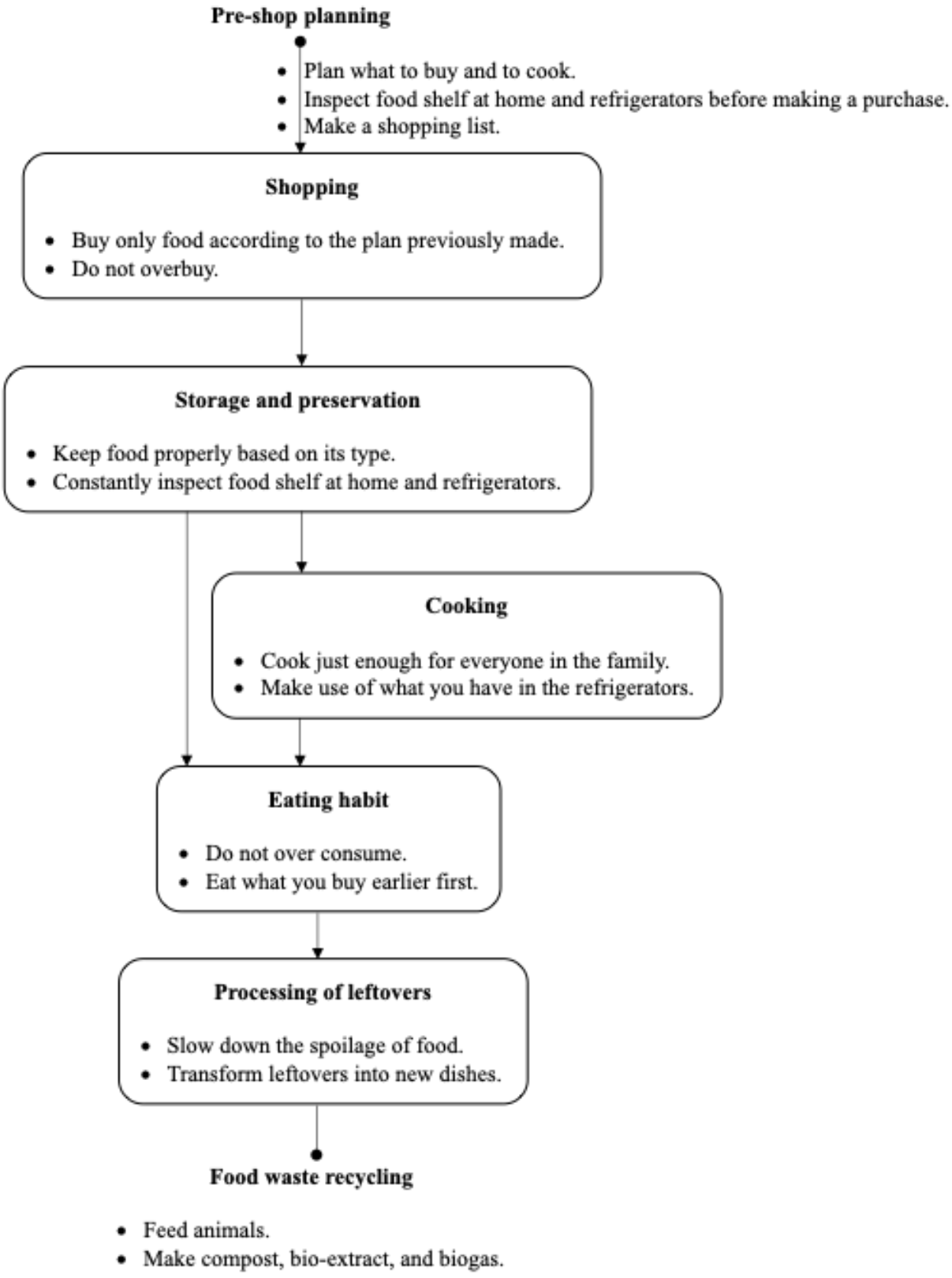


Figure 3.1 Conceptual Model of Food Waste Reduction by Thailand's researcher

Source: Srijuntrapun (2016) and Bunditsakulchai & Liu (2021)

(3) Srinakharinwirot University Activities for SDG 12

Survey data were gathered from five cafeterias in Srinakharinwirot University (SWU). The results found that all cafeterias had consumers of around 8,493 persons per day producing the waste of rice, food, vegetables, and fruits as much as 3.86 tons per day. This is seasonal waste depending on the semester of the university and the school with a minimum of 2.87 tons per day during vacation and a maximum of 4.41 tons per day per semester. The waste can be calculated as biogas production of around 698.4 m^3 per day. This can replace 319.6 kg LPG, and produce electricity valuing 0.021 megawatts (Newman et. al., 2016).

Over the past four years, SWU has encouraged all departments to create activities to support SDG 12. The selected activities are summarized as follows: in 2018, Recycling Program for University Waste[1] was done. Recycle bins are found all over the campus. Plastic, aluminum, and glass are separated at the point of disposal (Figure 3.2). SWU has introduced several campaigns to reduce the use of paper and plastic on campus, such as reducing the use of plastic water bottles by providing free water distribution and reducing the use of plastic bags by providing all freshmen the cloth bags. In addition, as an effort to reduce waste – from 9th August 2018, third-party vendors (shops, restaurants, and hospital) were instructed to minimize handing out plastic bags and plastic food containers. The recyclable waste is sorted and transferred to appropriate recycling plants.

Figure 3.2 Recycling Program for University Waste by SWU

Source: https://sdg.swu.ac.th/projects/20381/preview, [June 6, 2022]

[1] https://sdg.swu.ac.th/projects/20381/preview , [June 6, 2022]

On September 15th, 2019, 80 students from the Faculty of Social Sciences, Faculty of Humanities, Faculty of Fine Arts, International College for Sustainability Education and Faculty of Environmental Culture and Ecotourism, SWU, the foreigners, and Trash Hero Bangkok collaborated with the Department of Drainage and Sewerage, Bangkok Metropolitan Administration to collect a lot of trash along San Saeb canal and within SWU[2] (Figure 3.3). The total amount of trash on San Saeb canal was approximately 240 kg, and the trash in SWU was 48.8 kg including 15 kg of recycled waste consisting of plastic bags, rigid plastic, glasses, 1.0 kg of foam, and 32.3 kg of general trash.

Figure 3.3 Trash Hero by SWU

Source: https://sdg.swu.ac.th/projects/67/preview, [June 6, 2022]

In 2021, Recycle Waste Bank Program Srinakharinwirot University, Ongkharak District[3], hosted a workshop disseminating the knowledge of waste management and sorting garbage properly for students, faculty members, housewives, and SWU staff (Figure 3.4). The impacts expected were to reduce the amount of waste, to reduce the cost of solid waste disposal in the community, to generate income from selling recycled waste, to educate a clearer separation of waste, to reduce bad odor pollution from the garbage.

[2] https://sdg.swu.ac.th/projects/67/preview , [June 6, 2022]

[3] https://sdg.swu.ac.th/projects/60402/preview , [June 6, 2022]

Figure 3.4 Recycle Waste Bank Program SWU, Ongkharak District

Source: https://sdg.swu.ac.th/projects/60402/preview, [June 6, 2022]

Green Library Project, promoting waste sorting, such as plastic bottles, used paper, and hazardous waste in the library for users and staff by providing trash bins in each library story according to garbage types as well as making campaigns and distributing knowledge concerning power reservation and the environment through several channels like Facebook, Line, billboard, etc. and produces the numbers of selected plastic bottles as many as 400 kilos/year and recycled paper as much as 800 kilos/year.[4]

On April 22nd, 2021, the student representatives from the Faculty of Environmental Culture and Ecotourism, SWU, the foreigners, and Trash Hero Bangkok collaborating with Faculty of Environmental Culture and Ecotourism Srinakharinwirot University joined the cleanup activities around Taco Lake at Bangpli, Sumutprakan Province in Trash Hero Bangkok volunteers on Earth Day activities[5]. We collected a lot of trash along Taco Lake, with the total amount approximately 25.2 kg; then, we did a brand audit to identify both brands and types of waste in further information to built-up the awareness and perception of the people. Furthermore, we organize the activities to create awareness of environmental quality and conservation with respect to the impacts; establish both the best practice and standard operating procedures in waste collection and waste segregation, and enhance the understanding of waste segregation and environmental protection.

[4] https://sdg.swu.ac.th/projects/356/preview, [June 6, 2022]

[5] https://sdg.swu.ac.th/projects/70584/preview , [June 6, 2022]

3.2 Overview on Food Waste Situation in Indonesia: Survey of literature

The National Waste Management Information System, Ministry of Environment and Forestry of Indonesia, states that Indonesia's total solid waste in 2021 was 28,567,530.41 tons per year. Of this amount, 64.91% had been managed by waste management facilities in each region, and the remaining 35.09% was unmanaged. A study from Damanhuri et al. (2009) states that only 60% - 70% of solid waste in Indonesia is taken to landfills, while the rest is not managed correctly and usually disposed in open spaces or rivers.

Solid waste data in Indonesia and several selected provinces in 2019-2021 are presented in Table 3.4 (in ton unit per year). Most solid waste-producing provinces are in Java, such as East Java, Central Java, West Java, Banten, and Jakarta. It is linked to the condition of Java, Indonesia's most populous island, with a population of 151.59 million or 56.10% percent of the total Indonesian population. The data from Yogyakarta Province is also presented to represent Gadjah Mada University **(**UGM) as the focus of the study. The data of 2019 were derived from 243 cities/districts, and those from 2020 and 2021 were collected from 276 and 194 cities/districts in Indonesia respectively.

Table 3.4 Solid Waste in Indonesia and the Selected Provinces from 2019 to 2021 (Unit: 000 Tons per year)

Year	Indonesia	East Java province	Central Java province	West Java province	Banten province	Jakarta province	Yogyakarta province
2019	29,205.02 (100%)	5,497.16 (18.82%)	3,746.51 (12.83%)	3,389.68 (11.61%)	2,425.29 (8.30%)	2,008.55 (6.88%)	783.65 (2.68%)
2020	32,780.17 (100%)	5,876.64 (17.93%)	4,354.21 (13.28%)	4,045.35 (12.34%)	1,674.28 (5.11%)	3,054.81 (9.32%)	775.30 (2.36%)
2021	28,567.53 (100%)	3,632.91 (12.72%)	5,008.45 (17.53%)	4,599.60 (16.10%)	926.13 (3.24%)	3,083.44 (11.79%)	586.27 (2.05%)

Note: The number in parenthesis means the percentage of waste in each province

Source: National Waste Management Information System, Ministry of Environment and Forestry of Indonesia

Waste management performance is closely related to the number of existing waste management facilities. Indonesia has 22,602 waste processing facilities spread across 34 provinces in Indonesia (Table 3.5). Waste banks and the informal sector made the highest contribution to the waste management facility in Indonesia.

Table 3.5 Waste Management Facility in Indonesia (2021)

Waste Management Facility	Unit	Percentage (%)
Landfills	422	1.87
Waste bank	10,965	48.51
Small scale composting	2,648	11.72
Compost house	595	2.63
Organic processing center	539	2.38
Waste treatment unit-Reduce, Reuse, Recycle	1,691	7.48
Recycling center	68	0.30
Integrated waste treatment facility (except the landfills)	222	0.98
Intermediate treatment facility	4	0.02
Biodigester	123	0.54
Thermal process (Incinerator, Pyrolysis, Gasification)	24	0.11
Refuse-derived fuel	2	0.009
Informal sector (waste collector)	5,299	23.44
Total	**22,602**	**100.00**

Source: National Waste Management Information System, Ministry of Environment and Forestry of Indonesia

A study by Raharjo et al. (2018) states that biodegradable waste can be recycled in a waste treatment unit (3R) and integrated waste treatment facility using a composting or anaerobic digester. Meanwhile, commercial waste can be collected from customers (sources),

sorted, processed, and sold to the recycle agents/factories by the solid waste bank, waste treatment unit (3R), integrated waste treatment facility, and waste collector. An overview of waste management facilities in Indonesia is presented in Figure 3.5.

(a) Landfills in Bekasi, West Java, (b) Waste banks in Magelang, Central Java

(c) Compost house in Batang, Central Java, (d) Waste treatment unit 3R in Magelang, Central Java

Figure 3.5 Waste Management Facility in Indonesia

Source: (a) https://megapolitan.okezone.com/read/2021/09/12/338/2470100/

(b) https://www.republika.co.id/berita/ouibfj352/

(c) https://berita.batangkab.go.id/?p=1&id=8660

(d) https://dkptkotamagelang.wordpress.com/2013/12/28/, [June 6, 2022]

The composition of solid waste in Indonesia is primarily from household waste (Trihadiningrum et al., 2017). The data from the National Waste Management Information System show that the percentage of household waste increased from 2019 to 2021 (Table 3.6).

In 2021, the total household waste was 40.79%, and the rest came from offices, commercial areas, traditional markets, public facilities, and other areas. These data are in line with the previous studies by Khair et al. (2019) and Trihadiningrum et al. (2017), which state that household waste contributes to one-third of the waste disposed in the landfills daily. The amount of household waste is dominated by organic waste at 74.43%, and the rest is plastic and paper waste. In addition, a study by Qonitan et al. (2021) also states that household waste in major cities in Indonesia reaches 0.69 kg/capita/day. Based on its composition, solid waste comes from food waste, wood, paper/paperboard, plastic, metal, cloth, rubber/leather, glass, and others. The highest percentage comes from food waste (Table 3.7).

Table 3.6 Source-based Solid Waste Composition in Indonesia from 2019 to 2021

Waste source	Ratio		
	2019	**2020**	**2021**
Household	39.71%	40.27%	40.79%
Office	4.64%	3.51%	8.18%
Commercial areas	9.09%	8.06%	18.16%
Traditional Market	18.44%	16.85%	17.33%
Public Facility	5.65%	4.69%	6.33%
Area	8.14%	13.64%	5.83%
Others	14.33%	12.98%	3.38%
Total	**100%**	**100%**	**100%**

Source: National Waste Management Information System, Ministry of Environment and Forestry of Indonesia

Indonesia is one of the largest food waste-producing countries globally (in the second rank after Saudi Arabia). Population growth and changes in consumption patterns have increased the amount and types of waste in Indonesia. Every year, there is an increase in the number of landfills in Indonesia, which accommodate more food waste (Chen et al., 2021).

Based on a study by the Ministry of National Development Planning collaborating with the World Resources Institute, food waste in Indonesia from 2000 to 2019 was recorded at 23-48 million tons per year, or equivalent to 115 - 184 kg/capita/year. Food waste causes losses reaching 213 - 551 trillion rupiah, equivalent to 4 - 5% of Indonesia's GDP.

Table 3.7 Solid Waste Composition in Indonesia from 2019 to 2021

Waste	Ratio		
	2019	**2020**	**2021**
Food waste	40.44%	39.76%	40.27%
Wood	16.41%	14.75%	13.32%
Paper/paperboard	11.47%	11.74%	11.75%
Plastic	15.93%	17.15%	17.61%
Metal	3.30%	3.17%	3.07%
Textiles/cloth	2.40%	2.59%	2.50%
Rubber/leather	1.74%	1.86%	1.82%
Glass	2.08%	2.20%	2.34%
Others	6.23%	6.78%	7.32%
Total	**100%**	**100%**	**100%**

Source: National Waste Management Information System, Ministry of Environment and Forestry of Indonesia

(1) Determinants of food waste generation

Several studies in Indonesia have identified the determining factors of food waste behavior. In terms of socio-economic factor, the gender of the head of household (Hadiningrat, 2020) and young consumers (Mganga et al., 2021) affect the amount of food waste. As explained by Hadiningrat (2020), women have an essential role in managing food waste in their

home environment. They are responsible for handling food-related activities such as shopping for groceries, storing them, cooking them, and managing the waste. The study found that food waste management in Indonesia could improve if women were empowered. The involvement of women's organizations and communities can improve the reduction and management of food waste in the household and community. Furthermore, Mganga et al. (2021) found that the potential group that wasted more food was young consumers (adolescents), where the majority of this group was in the environment of higher education institutions.

In terms of economic factor, income and social status have a role in food waste behavior. Soma (2020) has found a positive effect between self-reported household food waste and income. Around 32.3% of respondents from high-income households stated that they disposed a lot of food waste, and none of the high-income households stated that they did not have waste. In addition, Soma (2017) stated that knowing the household interclass, namely, who determined what was “food” and what was “waste,” was critical to understanding the broader issue of food waste and promoting food waste prevention strategies. Preventing food waste can be carried out by giving food leftovers from high-income households to low-income households or between employers and housemaids.

In terms of habits, Pamela et al. (2019) find that individual habits determine food-wasting behavior, such as parental knowledge, planning when preparing food, and shopping. It is essential to increase the parental knowledge through public advertising and practicing management principles when planning food and shopping. Now, regarding the store characteristics, Soma (2020) found a significant effect between the quantity of food waste and retail types, with 75.9% of respondents claiming to waste a “significant amount” of food while shopping at supermarkets. It is important to note that the choice of retail types is related to income in the Indonesian context. Therefore, food waste reduction interventions should consider the role of retail types and income.

In terms of moral attitude, Indonesia has substantial cultural and spiritual factors that can influence food waste behavior. Research conducted by Soma (2020) mentioned that more than 80% of respondents stated their agreement with the following statements: People will think I am wrong if I throw away food, religion forbids me to throw away food, and the culture forbids me to throw away food. Reinforcing this finding, Soma (2016) reveals the strategy of housewives in Indonesia to reduce food waste, namely by telling a folk story to their children

about “The Tale of the Crying Rice”. This story becomes a traditional cultural heritage that aims to instill moral values and the need to respect and appreciate food.

(2) Food Waste Management

Waste has become a global problem around the world, including in Indonesia. It needs extra attention and proper handling from all relevant parties and the. Saliem et al. (2021) stated that food loss and waste (FLW) had become a global issue in achieving Indonesia’s SDGs targets. Reducing FLW by 25% can increase the availability of rice food in Indonesia by about 4 kg/capita. Therefore, a holistic policy is needed in FLW reduction policies at the national level, namely through food supply chain technology from the production stage to food distribution, as well as campaigns for consumer habits, restaurants, and food stores in serving and consuming food. Furthermore, the strategy to reduce FLW also requires dissemination, education, and massive movement from all interested parties.

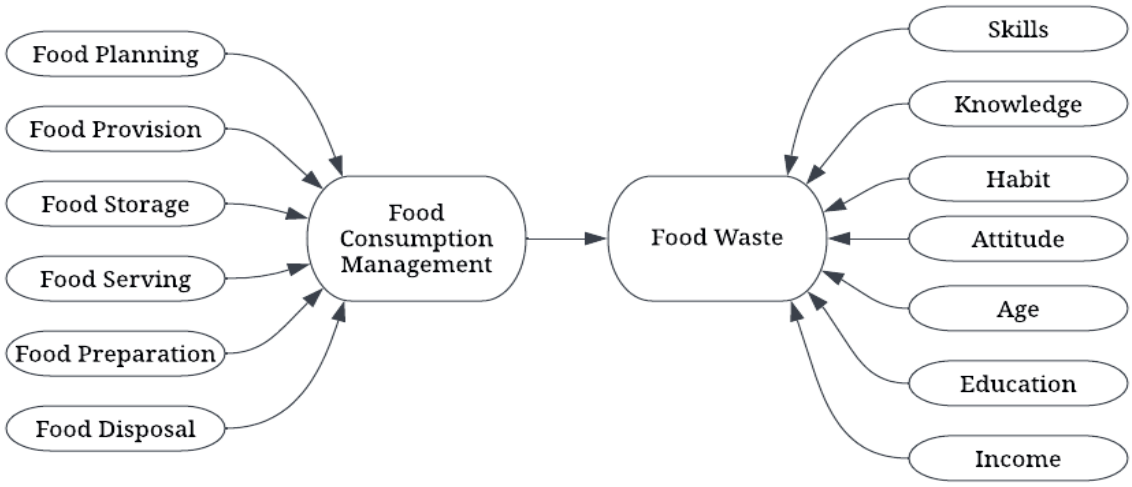


Figure 3.6 Conceptual Model of Food Consumption Management and Food Waste by Indonesia’s Researcher

Source: Mulyo *et al.* (2022)

Previous studies have found various efforts to improve food waste management in Indonesia. Mulyo et al. (2022) researched four major cities in Indonesia (Yogyakarta, Surabaya, Medan, and Denpasar) and discovered that food waste management could be

increased by implementing food consumption management. The management refers to household-level activities such as food planning, provision, storage, preparation, serving, and waste disposal. The research model is presented in Figure 3.6.

Furthermore, the research by Kurniawan et al. (2021) in the case of Sukunan Village (Yogyakarta) supports the waste reduction through community-based waste management (PSBM) by mobilizing local communities to separate waste (organic and non-organic) and recycle waste. In line with this research, Trihadiningrum et al. (2017) also found that applying the 3R (Reduce, Reuse, Recycle) program in Surabaya, Indonesia reduced residential solid waste by 67.92%, by recycling waste and composting. However, public awareness and participation are still low, so it is necessary to increase self-awareness in implementing the 3R program.

Other efforts in the development of food waste management have increased the public awareness and taught people to reduce and sort waste starting from the household level (Khair et al., 2019). Dhokhikah et al. (2015) added other activities, namely disseminating information about waste management through mass media and campaigns, increasing environmental cadres, and optimizing the existence and functions of waste banks. The importance of raising public awareness regarding food waste management was also stated by Fox et al. (2018). The study identified the consumers' knowledge and awareness of food waste in Indonesia, Denmark, Greece, and Taiwan and involved 610 respondents from the millennial generation category. The results found that consumers were already aware of food waste impacts, but they did not know their contribution to generating food waste. Susilo et al. (2021) also revealed the constraints in food waste management in Indonesia. Most sample respondents disposed food waste more often than recycled it because of the lack of public understanding of food waste management.

Regarding the role of educational institutions in encouraging waste management, the previous study conducted by Cahyanti *et al.* (2019) find that UGM designed the Waste Management Center as part of the education and recreation program. In this program, UGM develops a Shaft Garden to create a visual and spatial experience of biogas and compost management; utilizing gravity as a utility distribution system; and ordering the space according to its function. In addition, UGM has also developed a 9R framework (Reuse, Reduce, Recycle, Refill, Replace, Repair, Replant, Rebuild, and Reward) to provide added value to environmental, economic, socio-cultural, and health aspects of waste management. In addition,

Kusumawanto and Setyowati (2019) discovered that the waste management system at UGM had applied green engineering principles to support sustainable development. UGM has applied 12 principles of green engineering for campus waste management to select renewable waste processing technology according to the types of campus waste generation. Based on GreenMetric's assessment, UGM has a sustainability score of 10.50% out of 18%.

From Semarang State University, Fathoni et al. (2021) studied the waste management system by separating it into four groups and processing it with different methods. Leaves were recycled into compost and food waste into black soldier fly (BSF) maggots. Plastic, bottles, and paper waste were distributed to third parties. The remaining unsorted waste (twigs or branches, broken glass, plastic) was turned into ashes by environmentally friendly incinerators. This system could effectively handle up to 5 tons of waste per day.

In special cases during the pandemic, Christine et al. (2021) identified the awareness of Indonesian and Japanese students about food waste before and during the pandemic. The lockdown policy during the pandemic made people decide to cook at home (not buying food from outside) to practice cooking skills and raise awareness of not producing leftovers, given the difficulty of finding food during the pandemic. This condition also increases awareness in planning for shopping, namely by making food and shopping lists and checking products' expiration dates. These activities have cumulatively increased Indonesian students' awareness of food waste during the pandemic. Moreover, regarding the role of government policy, Cahyani et al. (2022) stated that Indonesia's government regulations were limited to organic and non-organic waste, and none explicitly discussd food waste. For this reason, it is necessary to formulate more detailed regulations regarding food waste management to be followed by the community.

(3) Gadjah Mada University Activities for SDG 12

The implementation of integrated waste management is essential in supporting the UGM target to become the Educopolis Campus. Recycling and waste management programs are one of UGM's primary concerns. The programs required are toxic waste treatment, organic and inorganic waste treatment, wastewater disposal, and paper and plastic use reduction programs. Based on UI Greenmetric 2018, UGM ranks the highest in the waste management category in Indonesia. This assessment evaluates six aspects: Setting and Infrastructure, Energy and Climate Change, Waste, Water, Transportation, and Education and Research. UGM excels

in the Waste category based on the waste facilities available in the campus area, namely the Recycling Innovation House (RInDU) facility at UGM AgroTechnology Innovation Center (PIAT) (Figure 3.7). RInDU is an integrated facility between large-scale waste and waste processing and research facilities that have been established and running since 2011. RInDU develops various fermentation-based, thermal, and mechanical methods and technologies.

((a & b) Recycling Innovation House (RInDU), (c) Temporary liquid waste storage

Figure 3.7 Waste Management Facility in UGM

Source: (a) https://piat.ugm.ac.id/gallery/reswat-gallery/

(b & c) https://insgreeb.ft.ugm.ac.id/smart-and-green-campus/waste-2/, [June 6, 2022]

RInDU has a 3R-based waste processing concept (Reduce, Reuse, Recycle). The collected waste is separated into two types (reusable and non-reusable). Reusable waste (plastic bottles and paper) is turned into crafts. The non-reusable waste, including plastic, food waste, and twigs, will be sorted manually before use. The results of the sorting will distinguish plastic and organic waste. Organic waste will be chopped and composted; plastic waste will be chopped and pyrolyzed into fuel, while the remaining residues will be disposed to the incinerator.

There are two fundamental technologies that RInDU has developed. The first technology is fermentation-based which includes composting and bio gasification. The second technology is thermally-based. RInDU also develops mechanical-based technologies, such as drying, chopping, flouring, and pelletizing. Fermentation and pelletization technology are applied to livestock waste such as feces, urine, blood, and fur of livestock processed into various valuable goods. Thermal technology is the pyrolysis of plastic waste using the help of

catalysts. RInDU can process plastic waste into fuel for about four tons every month. Another thermal technology is hydrothermal technology, with the advantage of processing all types of waste without being sorted (except glass and iron) into liquid fuel. RInDU receives 60 tons of waste every month, and at least 5,040 tons have been managed by RInDU into various high-use products. However, RInDU has not been able to manage waste from outside UGM. RInDU is still focused on reducing the waste produced by UGM so that it does not burden the Landfills in Yogyakarta[6].

(a) Organic waste management training (b) Inorganic waste management training

Figure 3.8 UGM Student Activity in Community Service

Source: (a) https://ugm.ac.id/id/berita/21993-mahasiswa-ugm-berdayakan-masyarakat-melalui-pengelolaan-sampah-organik,
(b) https://www.ugm.ac.id/en/news/18012-resolving-waste-ugm-students-use-worm-reactor, [June 6, 2022]

UGM student activities related to community service in waste management are described as follows: On December 22nd, 2021, UGM students empowered the community around Waste treatment unit 3R Randu Alas, Sleman, Yogyakarta through organic waste management by integrating livestock, fisheries, Black Soldier Fly cultivation, and the manufacture of organic liquid fertilizer and compost[7] (Figure 3.8 a). On May 19th, 2019, the Community Service team and UGM students held an environmental development program by

[6] https://piat.ugm.ac.id/2018/03/12/teknologi-inovasi-daur-ulang-dari-ugm/ Access date June 6, 2022
[7] https://ugm.ac.id/id/berita/21993-mahasiswa-ugm-berdayakan-masyarakat-melalui-pengelolaan-sampah-organik Access date June 6, 2022

utilizing organic waste through the worm reactor and providing training on the management of inorganic waste into goods of economic value[8] (Figure 3.8 b).

(a) Automatic waste sorting machine, (b) Eco Lindi, (c) Inorganic waste machine

Figure 3.9 UGM Student Innovation in Waste Treatment

Source: (a) https://www.ugm.ac.id/en/news/18077-gemilpah-waste-separator-machine-by-ugm-students

(b) https://biologi.ugm.ac.id/2022/02/18/

(c) https://sustainabledevelopment.ugm.ac.id/2019/07/31/ugm-students-develop-a-tool-to-convert-plastic-waste-into-fuel/

[June 6, 2022]

[8] https://www.ugm.ac.id/en/news/18012-resolving-waste-ugm-students-use-worm-reactor Access date June 6, 2022

Regarding community service activities, UGM students also create innovative and technological work to support waste management, such as Gemilpah or Automatic Waste Sorting Machine equipped with image processing, which helps the process of classifying waste precisely so that it can overcome waste problems[9] (Figure 3.9 a); Eco Lindi technology, which is the liquid that can be used to neutralize the unpleasant odor of garbage in landfills and traditional market environment[10] (Figure 3.9 b). Machine technology can convert inorganic waste such as plastic waste into fuel in the form of bio-oil and biogas[11] (Figure 3.9 c).

3.3 Concluding Remarks

Based on the data from Thailand and Indonesia, the provinces with the most solid waste generation are related to their density of population. Unsurprisingly, Bangkok province as the capital city of Thailand has the highest proportion of solid waste up to the present time. The other significant provinces are Chonburi (Eastern region), Nakhon Ratchasima (Northeastern region), and Chiang Mai (Northern region). Similarly, Java, Indonesia's most populous island, is the most essential island to generate solid waste. The provinces include East Java, Central Java, West Java, Banten, and Jakarta. In terms of solid waste composition, the amount of food waste in both countries has been the highest proportion. In the case of Thailand, the food waste data were derived from the previous literature, while the official data on food waste in the case of Indonesia are available on the website of the Ministry of Environment and Forestry.

With respect to the determinants of food waste generation, the socio-economic variables have a significant role in food waste behavior of Indonesians, while one previous literature in the case of Bangkok province implies that those variables are not statistically significant. Besides, in terms of habits, both Thailand's and Indonesia's individual habits determine food-waste behavior. The habits are such as frequency of checking food in the refrigerator before shopping, planning before shopping, etc. Apart from this, in the case of Indonesia, cultural and spiritual factors can influence food waste generation, for example, people will think I am wrong if I throw away food, religion forbids me to throw away food, and the culture forbids me to throw away food.

[9] https://www.ugm.ac.id/en/news/18077-gemilpah-waste-separator-machine-by-ugm-students Access date June 6, 2022
[10] https://biologi.ugm.ac.id/2022/02/18/, [June 6, 2022]
[11] https://sustainabledevelopment.ugm.ac.id/2019/07/31/ugm-students-develop-a-tool-to-convert-plastic-waste-into-fuel/, [June 6, 2022]

Instead of recycling food waste with the mega project, an important effort in food waste management increases public awareness and teaching people to reduce and sort waste starting at the household level. In the case of Indonesia, lack of understanding of food waste management leads to the disposal of food. Also, Indonesian consumers are already aware of the food waste impacts, but they do not know their contribution to generating food waste. On the other hand, Thailand households have moderate to high level of knowledge about food waste management. Therefore, the conceptual model of household food consumption behavior has been proposed by Thailand and Indonesia researchers. Both conceptual frameworks are based on food management along with daily food consumption activities such as food planning, provision, storage, preparation, serving, and waste disposal.

As SDG 12.3 particularly focuses on the role of educational institutions in encouraging waste management, both SWU and UGM have created many activities up to the present time. The selected activities of SWU are Recycling Program for University Waste, Trash Hero by SWU, Recycle Waste Bank Program, etc. At the same time, the selected activities of UGM are Organic Waste Management Training Program, Inorganic Waste Training Program, etc. In addition, UGM excels in the waste category based on the waste facilities available in the campus area, namely the Recycling Innovation House facilities at the UGM AgroTechnology Innovation Center. Also, UGM student innovations in waste treatment include automatic waste sorting machines, inorganic waste machines, etc. Therefore, based on UI Greenmetric 2018, UGM ranks the highest in the waste management category in Indonesia.

Chapter 4

Empirical Results

4.1 Food Waste Awareness

(1) Case Study of SWU Undergraduate Students

With regard to the characteristics of the respondents, most respondents are female. They come from various science majors (7 faculties) and social sciences (6 faculties). Moreover, most of the science major respondents are from the Faculty of Pharmacy, Faculty of Engineering, and Faculty of Agricultural Product Innovation for Sustainability. In addition, most of the social science and humanity major respondents are from Faculty of Economics, Faculty of Social Business Administration, and Faculty of Social Sciences. The average of respondents' age is 20.8 years (Table 4.1.1). The results of food waste (FW) awareness are grouped into 6 aspects: (i) Perception of FW reduction consequences and its practical benefits (ii) Health awareness, (iii) Economic awareness, (iv) Social and cultural awareness and FW guilt, (v) Environmental awareness, and (vi) FW reduction potential. The details of each part are as follows.

Table 4.1.1 Characteristics of SWU Respondents

Category / Attribute	Number of Respondents	Percent / Average
Gender	**394**	**1000.00%**
Male	118	29.95%
Female	276	70.05%
Faculty	**394**	**1000.00%**
Faculty of Dentistry	3	0.76%
Faculty of Pharmacy	81	20.56%
Faculty of Agricultural Product Innovation for Sustainability	47	11.93%

Category / Attribute	Number of Respondents	Percent / Average
Faculty of Sciences	7	1.78%
Faculty of Nursing	3	0.76%
Faculty of Engineering	56	14.21%
Faculty of Physical Education	19	4.82%
Faculty of Humanities	11	2.79%
Faculty of Social Sciences	40	10.15%
Faculty of Fine Arts	1	0.25%
Faculty of Economics	84	21.32%
College of Social Communication Innovation	1	0.25%
Faculty of Social Business Administration	41	10.41%
Age	**394**	**20.8 years**

The average values of the variable of Perception of FW reduction consequences and its practical benefits reflect that SWU undergraduate students have an excellent awareness. This is because they strongly agree with four indicators. Firstly, they strongly agree that reducing household FW is an effective approach to minimize waste, and it contributes to a healthier environment for the next generation. Also, they strongly agree that household FW is a critical component of reducing landfill waste. In addition, they strongly agree that leftover food should be checked to make sure that the food is still edible, and throwing away food only if the package expiry date has passed reduces the chance of someone getting sick from eating the food. However, neither do they agree nor disagree with having enough time to worry about the amount of food wasted since it can be noticed that its standard deviation is rather high (1.11) (Table 4.1.2).

With respect to the variable of health awareness, its average value implies that SWU undergraduate students have a very good perception because they strongly agree that eating expired food will increase the possibility of being sick, e.g. consuming expired bread will cause a stomachache. However, they neither agree nor disagree with eating leftovers, e.g. recooking leftover rice into fried rice can damage my health. Moreover, they are neutral related to eating leftovers is harmful (Table 4.1.3). Within the "Agree" category from the second to sixth variables (Table 4.1.3 - 4.1.7), the average value of the economic awareness variable ranks the

highest (3.94). Surprisingly, SWU undergraduate students strongly agree that they can save money by reducing food waste, e.g. buying food as needed will reduce food waste and save money. They also strongly agree that FW causes economic problems, e.g. FW in large quantity will require higher cost to manage as well as a major source of wasting money. However, they perceive the FW impacts on price rather well, e.g. overconsumption contributes to high price of food. The indicators show rather high standard deviations (1.02 and 1.08) (Table 4.1.4).

The average value of the social awareness variable implies that SWU undergraduate students have a very good perception. This is because they agree with five indicators. Firstly, most respondents agree that they try to remind their friends, family, and people around them about the need to reduce food waste. At the same time, they agree that people who are important to them, e.g. parents, friends, and girl/boyfriend, consider their efforts to reduce the amount of food wasted. In terms of feeling guilty, most respondents agree that they feel guilty for throwing away food and when they generate food waste while many people do not have guaranteed access to edible food and when they generate food waste because it has a negative effect on the environment, economy, and society. There is only one indicator that reflects excellent perception of SWU undergraduate students, that is most respondents strongly agree that everyone should share the responsibility to reduce food waste. Furthermore, there are three indicators that reflect a good perception of SWU undergraduate students. Most respondents neither agree nor disagree with three indicators as follows: When they try to reduce the leftover food, people who are important to them, e.g. parents, friends, and girl/boyfriend tend to follow their eating habits. Also, most respondents do not mind if their guests eat all the food their family has prepared for them, and they rarely buy lots of fresh products to eat. However, their standard deviations are rather high (1.07 - 1.25) (Table 4.1.5).

Regarding the variable of environmental awareness, its average value can infer that SWU undergraduate students have a very good perception. This is because most respondents agree that they have knowledge about the environmental issues relating to food consumption and FW, namely purchasing environmentally friendly products, recycling and reusing leftover food, purchasing waste-reduction packaging, environmental labeling, Variety of environmental issues, e.g. food waste represents a great waste of freshwater and groundwater resources, etc. Moreover, most respondents strongly agree that reducing food waste can reduce environmental hazards because it can save the land, water, and energy that would have been used to make it. In addition, they strongly agree that FW causes environmental pollution because food waste produces a large amount of methane, which is more dangerous than CO_2 (Table 4.1.6). Finally,

the average value of the FW reduction potential variable implies that SWU undergraduate students have a very good perception. This is because most respondents agree that their household food waste is equal to other households of their size. They also agree that they tend to throw away less leftover food when they buy food in large quantity, e.g. buying vegetables in large quantities will tend to produce leftovers which will be thrown away, etc. However, their standard deviations are rather high (1.07 and 1.23). Most respondents agree that they plan to reduce household food waste by learning more about the negative impacts of food waste, i.e. increasing air pollution and wasting money, etc. Apart from that, most respondents neither agree nor disagree that it would be easy to reduce FW further. (Table 4.1.7).

In sum, according to the average values of all variables, SWU undergraduate students know well about six aspects of FW awareness: Health awareness, economic awareness, social-cultural awareness and FW guilt, environmental awareness, and FW reduction potential. Surprisingly, the average value of the indicators from economic awareness reflects that SWU undergraduate students strongly agree that they can save money by reducing food waste, e.g. buying food as needed will reduce food waste and save money. At the same time, they have an excellent awareness of the FW-reduction consequences and its practical benefits.

Those results are consistent with the information from the in-depth interview. Furthermore, the students get the knowledge about FW from social media, a course in SWU general education, and courses in high school. The results support the findings of Setti et al. (2018) and Fami et al. (2019), which indicate that ease of access and information can motivate and improve individual abilities in reducing food waste. The results from the in-depth interview reflect that the students are also concerned about the negative impacts of FW on environmental and economic issues. This is in line with the findings of Pelt et al. (2020) which reveal that information about food waste could be a motivation for changing food waste behavior and increasing environmental awareness.

In addition, based on the information from the in-depth interview, although they try to manage their food consumption to reduce the amount of FW, most of them have some food that needs to be thrown away because they do not really like to eat it as a result of their eating habits, e.g., chili, parsley, garlic, chicken skin, and more spicy food, etc. In terms of the campaign for FW reduction, they propose to make a video clip on TikTok and a Twitter Thread due to its popularity among the new generation. The contents are also supposed to be concentrated on food consumption management to reduce the amount of FW. At the same time,

the university may implement a policy about the options of food prices for small plates so as to support the eating habits of girl university students. Ultimately, it may lead to reducing leftover food on the plate.

Table 4.1.2 Perception of Food Waste Reduction Consequences and Its Practical Benefits in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
I believe that reducing household food waste is an effective approach to minimize pollution.	4.28	0.70	Strongly Agree
I believe that reducing household food waste contributes to a healthier environment for the next generation (e.g., a pile of food waste will cause air pollution (nitrogen and methane gas) which has a bad impact on newborns around landfills)	4.38	0.71	Strongly Agree
I believe that reducing household food waste is a critical component of reducing landfill waste.	4.11	0.84	Strongly Agree
I have enough time to worry about the amount of food wasted.	3.16	1.11	Neutral
Leftover food should be checked to make sure that the food is still edible (e.g. leftover rice needs to be checked whether it is edible or not).	4.19	0.82	Strongly Agree
Throwing away food if the package expiry date has passed reduces the chances someone will get sick from eating the food.	4.20	0.83	Strongly Agree
Average	**4.05**	**0.84**	**Strongly Agree (Excellent)**

Table 4.1.3 Health Awareness in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
I believe that eating expired food will increase the possibility of being sick (e.g., consuming expired bread will cause a stomachache).	4.27	0.82	Strongly Agree

Constructs and Measuring Items	Score	St. dev	Category
I'm worried that eating recooked leftovers (e.g., recooking leftover rice into fried rice) can damage my health.	2.99	1.20	Neutral
In my opinion, eating leftovers is harmful.	2.53	1.11	Neutral
Average	**3.26**	**1.04**	**Agree (Very good)**

Table 4.1.4 Economic Awareness in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
I know that food waste causes economic problems (e.g., food waste in large quantity will require a higher cost to manage).	4.08	0.80	Strongly Agree
Throwing away food is a major source of waste money.	4.02	0.95	Strongly Agree
I can save money by reducing food waste (e.g., buying food as needed will reduce food waste and save money).	4.24	0.89	Strongly Agree
Overconsumption contributes to high prices of food.	3.79	1.02	Agree
I can help control the prices of food by avoiding wastage.	3.89	0.96	Agree
Overconsumption increases the prices of goods.	3.59	1.08	Agree
Average	**3.94**	**0.95**	**Agree (Very good)**

Table 4.1.5 Social and Cultural Awareness and Food Waste Guilt in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
I try to remind my friends, family, and people around me about the need to reduce food waste.	3.77	0.78	Agree
I think everyone should share the responsibility to reduce food waste.	4.43	0.70	Strongly Agree

Constructs and Measuring Items	Score	St. dev	Category
People who are important to me (parents, friends, girl/boyfriend) consider my efforts to reduce the amount of food wasted.	3.70	0.92	Agree
When I try to reduce the leftover food, people who are important to me (parents, friends, girl/boyfriend) tend to follow my eating habit.	2.64	1.07	Neutral
I don't mind if my guests eat all the food I have prepared for them.	2.78	1.23	Neutral
I rarely buy lots of fresh products to eat.	2.95	1.25	Neutral
I feel guilty for throwing away food.	4.01	0.97	Agree
I feel guilty for generating food waste while many people do not have guaranteed access to edible food.	4.03	1.05	Agree
I feel guilty for generating food waste because it has negative effects on the environment, economy, and society.	3.91	0.99	Agree
Average	**3.58**	**1.00**	**Agree (Very good)**

Table 4.1.6 Environmental Awareness in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
I have knowledge about the purchase of environmentally friendly products (organic rice, organic vegetables, and organic fruits).	3.66	0.94	Agree
I have knowledge about food waste recycling (composting food waste) and reusing leftover food (recooking leftover rice into fried rice).	3.61	1.04	Agree
I have knowledge of the purchase of waste-reduction packaging.	3.88	0.94	Agree
I have knowledge of environmental labeling (e.g. organic ingredient labels, and eco-friendly labels).	3.60	1.00	Agree
I have knowledge about a variety of environmental issues (e.g., food waste represents a great waste of freshwater and groundwater resources).	3.73	0.97	Agree

Constructs and Measuring Items	Score	St. dev	Category
Reducing food waste can reduce environmental hazards because it can save the land, water, and energy that would have been used to make it.	4.19	0.86	Strongly Agree
Food waste causes environmental pollution because food waste produces a large amount of methane, which is more dangerous than CO_2.	4.21	0.91	Strongly Agree
Average	**3.84**	**0.95**	**Agree (Very good)**

Table 4.1.7 Potentials for Food Waste Reduction in SWU Case Study

Constructs and measuring Items	Score	St. dev	Category
My household food waste is equal to other households of my size.	3.44	1.07	Agree
It would be easy to reduce food waste further.	2.83	1.05	Neutral
I tend to throw away less leftover food when I buy food in large quantity (e.g., buying vegetables in large quantity will tend to produce leftovers which are then thrown away).	3.12	1.23	Agree
I plan to reduce household food waste by learning more about the negative impacts of food waste (e.g., increasing air pollution and wasting money).	3.72	0.85	Agree
Average	**3.28**	**1.05**	**Agree (Very good)**

(2) Case Study of UGM Undergraduate Students

The respondents' characteristics of UGM undergraduate students were reviewed based on gender, faculty, and age (Table 4.1.8). The majority of student respondents were female. The respondents were grouped based on each faculty representing the science majors (12 faculties) and social sciences majors (6 faculties). In the science major, most respondents came from the Faculty of Agriculture and the Faculty of Engineering. In the social science major, most respondents came from the Faculty of Sociology and the Faculty of Economics and Business. Furthermore, the average age of the respondents is 20.5 years which represents the

young generation. In this study, it can be seen how the young generation perceives FW awareness, which includes several aspects, namely: (i) Perception of FW reducing consequences and practical benefits of FW, (ii) Health awareness, (iii) Economic awareness, (iv) Social Cultural awareness, and FW guilt, (v) Environmental awareness, and (vi) FW potential reduction.

Table 4.1.8 Characteristics of UGM Respondents

Category / Attribute	Number of Respondents	Percent / Average
Gender	**396**	**100.00%**
Male	142	35.86%
Female	254	64.14%
Faculty	**396**	100%
Agriculture	87	21,97%
Livestock	12	3,03%
Geography	25	6,31%
Pharmacy	18	4,55%
Biology	1	0,25%
Dentistry	7	1,77%
Veterinary	15	3,79%
Medicine	16	4,04%
Forestry	11	2,78%
Mathematics and Science	14	3,54%
Engineering	43	10,86%
Agricultural Technology	14	3,54%
Economic and Business	21	5,30%
Philosophy	7	1,77%
Law	15	3,79%
Cultural Sciences	15	3,79%
Sociology	57	14,39%

Category / Attribute	Number of Respondents	Percent / Average
Psychology	18	4,55%
Age	396	20.5 years

The average score for the perception of FW reduction consequences and its practical benefits of FW is in the excellent category. This is supported by strongly agree responses on five indicators and only one indicator got neutral response. UGM undergraduate students responded strongly agree to five indicators, namely: 1) reducing household FW is an effective approach to minimize pollution, 2) reducing household FW contributes to a healthier environment for the next generation, 3) reducing household FW is a critical component of reducing landfill waste, 4) leftover food should be checked to make sure that the food is still edible, and 5) throwing away food if the package expiry date has passed reduces the chances someone will get sick from eating the food. Neither do they agree nor disagree with the indicator that they have enough time to worry about the amount of FW (Table 4.1.9).

Regarding health awareness, the average score of UGM undergraduate students' responses is in the very good category. UGM undergraduate students strongly agree that eating expired food will increase the possibility of being sick. They also agree that eating recooked leftovers can damage health. For this indicator, the standard deviation is rather high (1.08). In addition, they neither agree nor disagree that eating leftovers is harmful (the standard deviation is 1.06) (Table 4.1.10). The economic awareness of UGM undergraduate students has an average score in the very good category. Based on the eight indicators of economic awareness, four indicators have strongly agree responses and two indicators have agree response. UGM undergraduate students strongly agree that wasting food is a major source of wasting money and reducing FW can save money. In addition, they also strongly agree that excessive consumption contributes to high food prices and increases the price of goods. Regarding the other two indicators, UGM undergraduate students agree that FW causes economic problems (for example, large amount of FW will require higher costs to manage), and they can help control food prices by avoiding waste (Table 4.1.11).

Socio-cultural awareness and FW guilt of undergraduate UGM students have the average score in the excellent category. The five indicators received very agree responses including the statements asserting that everyone should share the responsibility to reduce FW, and people who are important (parents, friends, girl/boyfriend) consider their efforts to reduce the amount of FW. UGM undergraduate students also strongly agree that they feel guilty for

throwing food away, feel guilty for generating food waste while many people do not have guaranteed access to edible food, and feel guilty for generating food waste because it has negative effects on the environment, economy, and society. UGM undergraduate students also agreed that they had tried to remind friends, family, and people around them about the need to reduce FW. From social standpoint, they do not mind if the guests eat all the food that they have prepared for them. The indicators that have neutral responses are people who are important (parents, friends, girl/boyfriend) tend to follow their eating habit when they try to reduce the leftover food, and they rarely buy lots of fresh products to eat. These indicators score rather high standard deviation (1.10) (Table 4.1.12).

Environmental awareness of UGM undergraduate students has average score in the very good category. It can be seen from the agreed responses in the first to fifth indicators. These five indicators show that they have very good knowledge and understanding of purchasing environmentally friendly products, FW recycling (composting FW) and reusing leftover food (recooking leftover rice into fried rice), purchasing waste-reduction packaging, environmental labeling (e.g., organic ingredient labels, and eco-friendly labels) and a variety of environmental issues (e.g., FW represents a great waste of freshwater and groundwater resources). Another interesting finding is that the responses of strongly agree on the sixth and seventh indicators of environmental awareness. UGM undergraduate students strongly agree that reducing FW can reduce environmental hazards (saving the land, water, and energy that would have been used to make it). They also strongly agree that FW causes environmental pollution (produces a large amount of methane, which is more dangerous than CO2) (Table 4.1.13).

Regarding the FW reduction potential, UGM undergraduate students record the average score is in the very good category. Students gave neutral responses (neither agree nor disagree) for the first and second indicators, namely the indicator: my household FW is equal to other households of my size, and it would be easy to reduce FW further. The third indicator collects neutral responses from the students, that is they tend to throw away less food left over when they buy food in large quantity (e.g., buying vegetables in large quantity will tend to generate leftover which is then thrown away). This indicator has a rather high standard deviation (1.14). The good news is that students strongly agree with the last indicator, namely, they plan to reduce household FW by learning more about the negative impacts of FW (e.g. increasing air pollution and wasting money). This shows the high awareness and seriousness of UGM undergraduate students in reducing household FW (Table 4.1.14).

Furthermore, based on the average value of the variables, it can be concluded that UGM undergraduate students have excellent FW awareness in: 1) aspects of FW reduction

consequences and its practical benefits, 2) economic awareness, and 3) socio-cultural awareness and FW guilt. The other three aspects, namely health awareness, environmental awareness, and FW reduction potential, are in the very good category. Those results are in line with the previous studies. Parizeau et al. (2021) state that FW awareness is the main determining factor in household FW generation. In addition, Attiq et al. (2021) also adds that the factors of awareness of consequences, environmental knowledge, and feeling of guilt in wasting food have positive effects on FW reduction behavior. Awareness of the consequences and feeling of guilt are also determining factors in household decisions to reuse and reduce FW (Attiq et al. 2021).

FGDs between the research team and UGM undergraduate students also support this result. They state that the efforts to reduce FW had started with themselves and their families because their parents often advised them to always finish food and not waste it. In terms of culture, Indonesian people have substantial cultural and spiritual factors that can influence FW behavior. Parents give advice to their children to finish their food. There is even a traditional local wisdom telling if the children do not finish the food, the chicken will die. At that time, chickens were a valuable asset for families in Indonesia. Another example of cultural influence in Indonesia is a folk story about "The Tale of the Crying Rice". Soma (2016) stated that this story gave the early learning for Indonesian children in FW prevention and reduction. This story becomes a traditional culture that aims to instill moral values in children and the need to appreciate food and not waste the food. From the religious point of view, it is also forbidden to waste food, and students also express feelings of guilt and shame when they throw away food. They realize that many people still live in poverty and find it difficult to get food, so it is not good for them to waste food. Knowledge about food waste and its negative impacts are obtained from an early age in the family environment, strengthened when receiving formal education at school and university, and supported by the internet and social media. The role of the university is also to support increasing the knowledge and information about waste management. UGM already has waste facilities in the campus area, namely the Recycling Innovation House (RInDU) facility at the UGM AgroTechnology Innovation Center.

Efforts have been made by UGM undergraduate students to reduce FW, for example, by: 1) processing leftover rice into fried rice or "karak" (crackers made of rice) for family consumption or selling, 2) reminding brothers/sisters/friends to finish their food, 3) helping parents to check and organize food stored in the refrigerator to reduce the risk of vegetables or fruit going rotten and food going stale, and 4) separating the household waste into organic and

inorganic waste. Inorganic waste such as bottles, glass, plastic, cardboard, and paper is collected and sold. Organic waste is collected in the basket and used as animal feed (chickens, ducks, catfish) or as organic fertilizer.

Table 4.1.9 Perception of Food Waste Reduction Consequences and Its Practical Benefits in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
I believe that reducing household food waste is an effective approach to minimize pollution.	4.37	0.66	Strongly Agree
I believe that reducing household food waste contributes to a healthier environment for the next generation (e.g., a pile of food waste will cause air pollution (nitrogen and methane gas) which have bad impacts on newborn around landfills)	4.59	0.63	Strongly Agree
I believe that reducing household food waste is a critical component of reducing landfill waste.	4.69	0.61	Strongly Agree
I have enough time to worry about the amount of food wasted.	3.61	0.88	Neutral
Leftover food should be checked to make sure that the food is still edible (e.g., leftover rice needs to be checked whether it is edible or not).	4.44	0.69	Strongly Agree
Throwing away food if the package expiry date has passed reduces the chances someone will get sick from eating the food.	4.23	0.76	Strongly Agree
Average	**4.32**	**0.71**	**Strongly Agree (Excellent)**

Table 4.1.10 Health Awareness in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
I believe that eating expired food will increase the possibility of being sick (e.g., consuming expired bread will cause a stomachache).	4.51	0.63	Strongly Agree
I'm worried that eating recooked leftovers (e.g., recooking leftover rice into fried rice) can damage my health.	3.29	1.08	Agree

Constructs and Measuring Items	Score	St. dev	Category
In my opinion, eating leftovers is harmful.	3.13	1.06	Neutral
Average	**3.64**	**0.92**	**Agree (Very good)**

Table 4.1.11 Economic Awareness in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
I know that food waste causes economic problems (e.g., food waste in large quantity will require higher cost to manage).	3.96	0.81	Agree
Throwing away food is a major source of waste money.	4.31	0.81	Strongly Agree
I can save money by reducing food waste (e.g. buying food as needed will reduce food waste and save money).	4.64	0.54	Strongly Agree
Overconsumption contributes to high prices of food.	4.08	0.81	Strongly Agree
I can help control the prices of food by avoiding wastage.	4.02	0.77	Agree
Overconsumption increases the prices of goods.	4.10	0.79	Strongly Agree
Average	**4.19**	**0.76**	**Strongly Agree (Excellent)**

Table 4.1.12 Social and Cultural Awareness and Food Waste Guilt in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
I try to remind my friends, family, and people around me about the need to reduce food waste.	4.03	0.73	Agree
I think everyone should share the responsibility to reduce food waste.	4.60	0.56	Strongly Agree
People who are important to me (parents, friends, girl/boyfriend) consider my efforts to reduce the amount of food wasted.	4.24	0.74	Strongly Agree

Constructs and Measuring Items	Score	St. dev	Category
When I try to reduce the leftover food, people who are important to me (parents, friends, girl/boyfriend) tend to follow my eating habit.	3.51	1.10	Neutral
I don't mind if my guests eat all the food, I have prepared for them.	3.85	0.92	Agree
I rarely buy lots of fresh products to eat.	2.50	0.93	Neutral
I feel guilty for throwing away food.	4.57	0.59	Strongly Agree
I feel guilty for generating food waste while many people do not have guaranteed access to edible food.	4.75	0.49	Strongly Agree
I feel guilty for generating food waste because it has negative effects on the environment, economy, and society.	4.39	0.66	Strongly Agree
Average	**4.05**	**0.75**	**Strongly Agree (Excellent)**

Table 4.1.13 Environmental Awareness in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
I have knowledge about the purchase of environmentally friendly products (organic rice, organic vegetables, and organic fruits).	3.67	0.87	Agree
I have knowledge about food waste recycling (composting food waste) and reusing leftover food (recooking leftover rice into fried rice).	3.67	0.92	Agree
I have knowledge of purchasing waste-reduction packaging.	3.93	0.77	Agree
I have knowledge of environmental labeling (e.g., organic ingredient labels, and eco-friendly labels).	3.58	0.91	Agree
I have knowledge about a variety of environmental issues (e.g., food waste represents a great waste of freshwater and groundwater resources).	4.01	0.73	Agree
Reducing food waste can reduce environmental hazards because it can save the land, water, and energy that would have been used to make it.	4.28	0.68	Strongly Agree

Constructs and Measuring Items	Score	St. dev	Category
Food waste causes environmental pollution because food waste produces a large amount of methane, which is more dangerous than CO_2.	4.32	0.69	Strongly Agree
Average	**3.92**	**0.80**	**Agree (Very good)**

Table 4.1.14 Food Waste Reduction Potential in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
My household food waste is equal to other households of my size.	3.64	0.85	Neutral
It would be easy to reduce food waste further.	3.51	0.88	Neutral
I tend to throw away less leftover food when I buy food in large quantity (e.g., buying vegetables in large quantity will tend to produce leftovers which are then thrown away).	2.87	1.14	Agree
I plan to reduce household food waste by learning more about the negative impacts of food waste (e.g., increasing air pollution and wasting money).	4.35	0.65	Strongly Agree
Average	**3.59**	**0.88**	**Agree (Very good)**

(3) Statistics Comparing Two Groups: SWU and UGM

Based on the results of seven variables for food awareness in the case study of SWU and UGM undergraduate students as previously presented, it can be concluded by comparing the two groups as follows: There are three variables of both the case of SWU and that of UGM which are in the same category, namely good, involving Health awareness, Environmental awareness, and FW reduction potential. On the other hand, there are three variables in the cases of SWU and UGM that are different in category. The variables of Perception of FW reduction consequences and its practical benefits, Economic awareness, as well as Socio-cultural awareness and FW guilt in the case of UGM are in the excellent category, while those variables in the case of SWU are in very good category. Moreover, based on the results of statistics

comparing the two groups, the *z*-statistics with *p*-value reflect that the average values of all variables in the case of UGM are greater than those of SWU with a statistical significance (*p*-value < 0.10, 0.05, and 0.01). (Table 4.1.15). The details of the indicators in each variable are as follows.

With respect to the results of statistics comparing two groups of indicators in the variable of perception of food waste reduction consequences and practical benefits of food waste, the average values of four indicators in the case of UGM are greater than those of SWU with a statistical significance (*p*-value < 0.01), namely Reducing household food waste contributes to a healthier environment for the next generation; Reducing household food waste is a critical component of reducing landfill waste; Concerning on the amount of food wasted; as well as Checking leftovers to make sure that the food is still edible. On the other hand, the average values of two indicators in the case of UGM are not statistically different from those of SWU at 0.10 level, namely Reducing household food waste is an effective approach to minimize pollution; and Throwing away food if the package expiry date has passed reduces the chances someone will get sick from eating the food (Table 4.1.15 a.). Surprisingly, in terms of the results of statistics comparing two groups of the indicators in the variable of health awareness, the average values of all indicators in the case of UGM are greater than those of SWU with a statistical significance (*p*-value < 0.01), namely Eating expired food will increase the possibility of being sick; Eating recooked leftovers can damage my health; and Eating leftovers is harmless (Table 4.1.15 b.).

Next, regarding the results of statistics comparing two groups of the indicators in the variable of economic awareness, the average values of four indicators in the case of UGM are greater than those of SWU with a statistical significance (*p*-value < 0.01), namely Throwing away food is a major source of waste money; Saving money by food waste reduction; Overconsumption contributes to high prices of food; as well as Over Consumption increases the prices of goods. On the other hand, the average values of two indicators in the case of UGM are not statistically different from those of SWU at 0.10 level, namely Food waste causes economic problems; as well as Helping control the prices of food by avoiding wastage. However, the average value of the indicator of Food waste causing economic problems in the case of UGM is less than that of SWU (Table 4.1.15 c.). As seen in the results of statistics comparing two groups, the indicators in the variables of socio-cultural awareness and food waste guilt, only the indicator of buying lots of fresh products that will be eaten in the case of UGM is less than that of SWU with a statistical significance (*p*-value < 0.01). On the other

hand, the average values of the rest indicators in the case of UGM are greater than those of SWU with a statistical significance (p-value < 0.05 and 0.01) (Table 4.1.15 d.).

According to the results of statistics comparing two groups of indicators in the variable of environmental awareness, the average values of four indicators in the case of UGM are not statistically different from those of SWU at 0.10 level, namely Having knowledge about the purchase of environmentally friendly products; Having knowledge about food waste recycling and reusing leftover food; Having knowledge of the purchasing of waste-reduction packaging; as well as Having knowledge of environmental labeling. However, the average value of the indicator of Having knowledge of environmental labeling in the case of UGM is less than that of SWU. The average values of the rest of the indicators in the case of UGM are greater than those of SWU with a statistical significance (p-value < 0.05 and 0.01), namely Having knowledge about a variety of environmental issues; Having the knowledge that reducing food waste can reduce environmental hazards; as well as Having knowledge that food waste causes environmental pollution (Table 4.1.15 e.). The last, based on the results of statistics comparing two groups on the indicators of the food waste reduction potential variable, only the average value of tending to throw away more leftover food when buying food in large quantity in the case of UGM is less than that of SWU with a statistical significance (p-value < 0.05). On the other hand, the UGM average values of the rest indicators are greater than those of SWU with a statistical significance (p-value < 0.05 and 0.01) (Table 4.1.15 f.).

From the above statements, overall results imply that food waste awareness of UGM undergraduate students seems to be better than that of SWU undergraduate students. This may be because UGM undergraduate students have a better perception of understanding food waste. This perception is closely related to the aspects of household knowledge and habits in treating food waste, which are repeated so it becomes the culture of Indonesian society. For example, early internalization to children regarding the importance of respecting food is presented in the form of folk tales such as “The Tale of the Crying Rice” and advice from parents such as “If you don't finish the food, the chicken will die”. At that time, chickens were a valuable asset for families in Indonesia. In addition, religious education in the family and at school also strengthens the values, one of which is a command not to be wasteful and to always respect food. At the university level, UGM facilitates waste management programs by establishing the Recycling Innovation House (RInDU) facilities at the UGM AgroTechnology Innovation Center. This facility is useful to seek knowledge and information about waste management.

Table 4.1.15 Results of Statistical Comparison between Two Groups (SWU and UGM)

a. Perception of Food Waste Reduction Consequences and Its Practical Benefits

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I believe that reducing household food waste is an effective approach to minimize pollution.	4.28	4.37	0.75 (0.62)
I believe that reducing household food waste contributes to a healthier environment for the next generation (e.g., a pile of food waste will cause air pollution (nitrogen and methane gas) which have a bad impact on newborn around landfills)	4.38	4.59	2.27 (0.00)***
I believe that reducing household food waste is a critical component of reducing landfill waste.	4.11	4.69	5.26 (0.00)***
I don't have enough time to worry about the amount of food wasted.	3.16	3.61	3.04 (0.00)***
Leftover food should be checked to make sure that the food is still edible (e.g. leftover rice needs to be checked whether it is edible or not).	4.19	4.44	1.78 (0.00)***
Throwing away food if the package expiry date has passed reduces the chances someone will get sick from eating the food.	4.20	4.23	0.72 (0.67)
Average	**4.05**	**4.32**	**3.95 (0.00)*** **

b. Health Awareness

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I believe that eating expired food will increase the possibility of being sick (e.g., consuming expired bread will cause a stomachache).	4.27	4.51	1.67 (0.00)***
I'm worried that eating leftovers (e.g., recooking leftover rice into fried rice) can damage my health.	2.99	3.29	2.14 (0.00)***
In my opinion, eating leftovers is harmless.	2.53	3.13	3.80 (0.00)***
Average	**3.26**	**3.64**	**4.89 (0.00)*** **

c. Economic Awareness

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I know that food waste causes economic problems (e.g., food waste in large quantity will require higher cost to manage).	4.08	3.96	0.91 (0.38)
Throwing away food is a major source of waste money.	4.02	4.31	1.82 (0.00)***
I can save money by reducing food waste (e.g., buying food as needed will reduce food waste and save money).	4.24	4.64	2.81 (0.00)***
Overconsumption contributes to high prices of food.	3.79	4.08	1.91 (0.00)***
I can help control the prices of food by avoiding wastage.	3.89	4.02	0.87 (0.43)
Overconsumption increases the prices of goods.	3.59	4.10	3.30 (0.00)***
Average	**3.94**	**4.19**	**2.27 (0.00)*** **

d. Social and Cultural Awareness and Food Waste Guilt

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I try to remind my friends, family, and people around me about the need to reduce food waste.	3.77	4.03	2.22 (0.00)***
I think everyone should share the responsibility to reduce food waste.	4.43	4.60	1.42 (0.04)**
People who are important to me (parents, friends, girl/boyfriend) consider my efforts to reduce the amount of food wasted.	3.70	4.24	4.08 (0.00)***
People who are important to me (parents, friends, girl/boyfriend) tend to overconsume when I try to reduce the leftover food.	2.64	3.51	5.34 (0.00)***
It would be a shame for me if my guests eat all the food, I have prepared for them. They might want to eat more.	2.78	3.85	5.87 (0.00)***
I regularly buy lots of fresh products to eat.	2.95	2.50	3.15 (0.00)***

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I feel guilty for throwing away food.	4.01	4.57	3.88 (0.00)***
I feel guilty when I waste food while many people do not have guaranteed access to edible food.	4.03	4.75	5.30 (0.00)***
I feel guilty when I waste food because it has negative effects on the environment, economy, and society.	3.91	4.39	2.79 (0.00)***
Average	**3.58**	**4.05**	**6.62 (0.00)*** **

e. Environmental Awareness

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I have knowledge about the purchase of environmentally friendly products (organic rice, organic vegetables, and organic fruits).	3.66	3.67	0.51 (0.96)
I have knowledge about food waste recycling (composting food waste) and reusing leftover food (recooking leftover rice into fried rice).	3.61	3.67	1.09 (1.18)
I have knowledge of purchasing waste-reduction packaging.	3.88	3.93	1.08 (1.19)
I have knowledge of environmental labeling (e.g., organic ingredient labels, and eco-friendly labels).	3.60	3.58	0.83 (0.50)
I have knowledge about a variety of environmental issues (e.g. food waste represents a great waste of freshwater and groundwater resources).	3.73	4.01	3.11 (0.00)***
I know that reducing food waste can reduce environmental hazards (e.g., saving the land, water, and energy that would have been used to make it).	4.19	4.28	1.50 (0.02)**
I know that food waste causes environmental pollution (e.g. food waste produces a large amount of methane, which is more dangerous than CO2).	4.21	4.32	1.57 (0.01)**
Average	**3.84**	**3.92**	**1.36 (0.05)***

f. Potentials for Food Waste Reduction

Constructs and measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
My household wastes more food than other households of my size.	3.44	3.64	1.56 (0.01)**
It would be difficult to reduce food waste further.	2.83	3.51	4.24 (0.00)***
I tend to throw away more leftover food when I buy food in large quantity (e.g., buying vegetables in large quantity will tend to produce leftovers which will then be thrown away).	3.12	2.87	1.42 (0.04)**
I plan to reduce household food waste by learning more about the negative impacts of food waste (e.g., increasing air pollution and wasting money).	3.72	4.35	3.99 (0.00)***
Average	**3.28**	**3.59**	**3.12 (0.00)*** **

Note: The figure in parenthesis means *p*-value of z-statistics. The asterisk *, **, and *** denoted statistically significant results at 0.10 (the *p*-value < 0.10), 0.05 level (the *p*-value < 0.05), and 0.01 level (the *p*-value < 0.01), respectively.

4.2 Estimation Results of the Amount of Food Waste and its Determinants

(1) Case Study of SWU Undergraduate Students' Households

The respondents are the head of household who is mainly in charge of food consumption at home or the wife of the head of household. Most of them are female (74.11%) and married (74.87%), staying in urban area (63.96%) (Table 4.2.1 a.). The average age is 51 years, while the minimum age is 38 years which is because the respondent was the younger sister of the student's mother and the student had been staying with her since his parents passed away. Apart from this, the average value of the school year is 13.15 years, which implies that most respondents' educational level is high school. Regarding the demographic perspective, the average number of household members is 4 persons. Moreover, the average number of children (< 17 years old) and elderly members of the households is 1 person. In terms of economic perspective, the average household income, expenditure, and food expenditure are 62,651.75; 36,277.55; and 16,130.15 THB/month respectively where 44.46% of the total expenditure is for food consumption (Table 4.2.1 b.).

Based on the results of 24-hour recall of food waste (FW) in the household of SWU undergraduate students, the top five FW items are Soup and curry, Meat including its products, Eggs including eggshells, Rice and noodles including their products, as well as Vegetables and fruits including their products. It also can be concluded that most of FW come from the leftovers. The details are as follows: 77.41% of respondents generate FW from Soup and Curry. Within this group, 65.25% originates from the leftovers that are disposed after being left on the plate, pot, pan, or bowl. Secondly, 59.64% of respondents give rise to FW from Meat including its products. Within this group, 45.73% comes from food that are disposed after partly used, while 41.88% arises from meal leftovers. Thirdly, 56.09% of respondents generate FW from Eggs including eggshells. Unsurprisingly, within this group, 68.78% comes from partly used food. Fourth, 47.21% of respondents bring about FW from Rice and noodles including their products. Within this group, 61.41% originates from the leftovers. the last is that 43.91% of respondents generate FW from vegetables and fruits including their products. Within this group, 61.41% comes from meal leftovers (Table 4.2.2).

Those results are consistent with the information from in-depth interviews. The participants informed us that Thai food basically originates from soup and curry waste because we cannot eat it all, such as Sour soup made of tamarind paste, Green curry, and Egg and Pork in Sweet Brown Sauce, etc. Apart from this, the above results can fill in the gap in the literature concerning the amount of FW, i.e., Silvennoinen et. al., (2014); Szabó-Bódi, Kasza, and Szakos (2018); and Blas, Garrido, and Willaarts (2018) who found that most of the FW items in the case of Finland, Hungary, and Spain are vegetables and milk products, bread, as well as meat, fish and animal fats, respectively. Zan et. al. (2018) revealed that most of the FW items in the case of Hong Kong were fruits and vegetables.

In addition, in terms of the amount of FW in household, the top five FW items are Soup and curry, Meat including its products, Eggs including eggshells, Vegetables and fruits including their products, as well as Rice and noodles including their products, all of which contribute about 26.07%, 20.63%, 13.23%, 11.45%, and 7.37% respectively of the total amount of FW in the household (Table 4.2.3). Moreover, in 2023 the estimated amount of FW is about 42.78 kg/capita. It is in line with the theme of Austria and Netherlands, which the United Nations Environment Programme (2021) reported that based on the confidence in estimates which is high confidence, household food waste estimates in those countries were 39 and 50 kg/capita/year respectively. Nevertheless, based on the confidence in estimates which is very low confidence, Thailand's household food waste estimate was 77 kg/capita/year. Within the

South-eastern Asia, the amount of household food waste in Vietnam, Indonesia, and Thailand are rather similar, those are 76, 77, and 79 kg/capita/year respectively.

Theoretically, the amount of FW has economic value. The estimation results of the FW value imply that each household of SWU undergraduate students can save money by about 559.42 THB (16.50 USD) per year. Although the household saving per year is not much, the economic losses of FW in the total household of SWU undergraduate students are supposed to be asserted because they reach about 12.57 Million THB (370,665.25 USD) per year according to the top five values of FW items where the economic losses come from the FW of Soup and curry, Meat including its products, Eggs including eggshells, Vegetables and fruit including their products, as well as Rice and noodles including their products amounting 3.28 Million THB (96,720.92 USD), 2.59 Million THB (76,374,14 USD), 1.66 Million THB (48,950.22 USD), 1.44 Million THB (42,462.84 USD), and 0.93 Million THB (27,432.92 USD) per year respectively (Table 4.2.3). These economic values can be reallocated into the public budget that the Thai government can spend more on the productive economic activities.

Table 4.2.1 Characteristics of the Households of SWU Respondents

a. Qualitative variables

Category / Attribute	Number of Respondents	Percent / Average
Gender	**394**	**100.00%**
Male	102	25.89%
Female	292	74.11%
Marital status	**394**	**100.00%**
Single	61	15.48%
Married	295	74.87%
Widowed	38	9.64%
Geographic area	**394**	**100.00%**
Rural area	142	36.04%
Urban area	252	63.96%

b. Quantitative variables

Category	Mean	Min	Max	Std. dev
Age (Years)	51.18	38.00	70.00	5.88
Education (Years)	13.15	0	21	3.91
Household members (Persons)	4.31	2	13	1.38
Children (< 17 years old) in household (Persons)	0.55	0	7	0.92
Elderly (> 60 years old) in household (Persons)	0.45	0	5	0.78
Household income (THB/month)	62,651.75	9,000	50,0000	67,733.18
Household expenditure (THB/month)	36,277.55	3,000	220,000	26,865.08
Household food expenditure (THB/month)	16,130.15	1,500	90,000	11,904.68

Table 4.2.2 Categories of 24-Hour Recall of Food Waste in the Household of SWU Undergraduate Students

Food Waste Item	Percent of Respondents	Categories of Food waste (Percent of Respondents)				
		Completely unused foods	Partly used foods	Meal leftovers	Leftovers after storing meals	Total
Rice and noodles including their products	47.21%	2.72%	20.65%	61.41%	15.22%	**100%**
Vegetables and Fruits including their products	43.91%	2.33%	50.58%	32.56%	14.53%	**100%**
Meat including its products	59.64%	0.43%	45.73%	41.88%	11.97%	**100%**
Eggs including eggshell	56.09%	1.36%	68.78%	22.17%	7.69%	**100%**
Seasoning	29.44%	21.01%	18.49%	49.58%	10.92%	**100%**

Food Waste Item	Percent of Respondents	Categories of Food waste (Percent of Respondents)				
		Completely unused foods	Partly used foods	Meal leftovers	Leftovers after storing meals	Total
Soup and curry	77.41%	0.98%	24.59%	65.25%	9.18%	**100%**
Dairy products	10.91%	6.98%	16.28%	48.84%	27.91%	**100%**
Drinks and beverages	26.14%	1.94%	26.21%	65.05%	6.80%	**100%**
Oil	35.79%	1.40%	8.39%	79.72%	10.49%	**100%**
Cereal and bread	10.91%	6.98%	27.91%	37.21%	27.91%	**100%**

Table 4.2.3 Estimation Results of the Amount and Value of Food Waste in the Household of SWU Undergraduate Students

Food Waste Item	Estimated Amount of Food Waste (gram(ml)/ household/ day)	Estimated Amount of Food Waste (kg/ capita/ year)	Estimated Value of Food Waste (THB/ household/ year)	Estimated Value of Food Waste (THB/total number of households of SWU undergraduate students/year)	Estimated Value of Food Waste (USD/total number of households of SWU undergraduate students/year)
Rice and noodles including their products	34.82	3.19 (7.37%)	41.24	927,030.45	27,336.35
Vegetables and Fruits including their products	54.06	5.07 (11.45%)	64.03	1,439,266.69	42,441.22
Meat including its products	97.46	8.89 (20.63%)	115.43	2,594,726.81	76,513.53
Eggs including eggshell	62.47	5.52 (13.23%)	73.99	1,663,170.37	49,043.71
Seasoning	9.02	0.92 (1.91%)	10.68	240,144.02	7,081.39
Soup and curry	123.12	11.07 (26.07%)	145.83	3,277,885.95	96,658.59
Dairy products	13.08	1.05 (2.77%)	15.49	348,235.45	10,268.80
Drinks and beverages	33.10	3.00 (7.01%)	39.20	881,238.02	25,986.02

Food Waste Item	Estimated Amount of Food Waste (gram(ml)/ household/ day)	Estimated Amount of Food Waste (kg/ capita/ year)	Estimated Value of Food Waste (THB/ household/ year)	Estimated Value of Food Waste (THB/total number of households of SWU undergraduate students/year)	Estimated Value of Food Waste (USD/total number of households of SWU undergraduate students/year)
Oil	30.68	2.72 (6.50%)	36.34	816,809.14	24,086.14
Cereal and bread	14.50	1.35 (3.07%)	17.17	386,040.82	11,383.61
Total	**472.31**	**42.78 (100%)**	**559.42**	**12,574,547.72**	**370,799.35**

Note: More details of the calculation are seen in the part of Method and procedure of Chapter 2.

The reasons of food wasted in the household of SWU undergraduate students is divided into four categories, namely Personal habits, Shopping habits, Product characteristics, and Moral attitude. According to the average scores of the variables, most of the respondents agree that all variables are the reasons that food gets wasted in their households. As is seen, the standard deviations of all variables are rather high (from 1.04 to 1.23). The details are as follows: in terms of Personal habits, the average scores of twelve indicators imply that the households of SWU undergraduate students strongly agree that Food safety is the reason that food gets wasted in their household. On the other hand, they agree with ten indicators, which are the reasons that food gets wasted in their household, namely Inconvenience, Taste dissatisfaction, Not eating what one needs to eat first, High frequency of buying food, Lack of cooking skills, Lack of storage knowledge, Preparing/Cooking too much at one time, Errors in serving and storing food, Lack of skills to process leftovers into new foods, and Throwing leftover food is common for the household members. Within these categories, Preparing/Cooking too much at one time, High frequency of buying food, and Taste dissatisfaction show rather high average score (3.76, 3.71, and 3.57). However, the households of SWU undergraduate students neither agree nor disagree with the Confusion between “Best Before Date (BBF)” and “Use by date” is the reason that food gets wasted in their households (Table 4.2.4 a.). It is consistent with the information from n-depth interviews. They know well about the definition of BBF and Expired dates.

Regarding Shopping habits, the household of SWU undergraduate students agree with all indicators, which are the reasons that food gets wasted in their household namely Buying foods in large quantities, Buying products that are not needed, Buying too many perishables, Lack of planning when shopping, Impulse purchases are usually due to special offers from sellers, and Spontaneous purchases because you are interested in the product while in the store. Within these categories, Buying foods in large quantities and Buying too many perishables show rather high average score (3.88 and 3.79 respectively). On the other hand, the average scores of the rest indicators are not different (Table 4.2.4 b.).

At the same time, in terms of Product characteristics, the households of SWU undergraduate students agree with all indicators as the reasons that food wasted in their households, namely Too large product packaging (not finished in one consumption), Fresh products with shorter shelf life, and Bad quality (easily damaged) packaging. Within these categories, Fresh products with shorter shelf life show the highest average score (3.90) (Table 4.2.4 c.). Surprisingly, regarding Moral attitude, the head of household or the wife of the head of household strongly agree that the desire to be an excellent example for families with an attitude of appreciation is the reason for food waste in their household. Meanwhile, they agree with four indicators, namely Throwing away food is a mistake, Throwing away food should not be done, Feelings of shame when disposing food waste, and Feeling guilty when disposing food waste. Within these categories, the first one shows the smallest average score (3.42), while the average scores of the rest indicators are not different (Table 4.2.4 d.).

Demographics and economic variables, as well as habit variables that reflect reasons for food wasted in their households are the essential factor affecting the amount of FW or not by the results of the estimation of the Tobit Model. Although Bunditsakulchai and Liu (2021) found that most socio-economic factors are not statistically significant according to the results of the estimation of the log-linear regression of the factors affecting the frequency of throwing food in the case of Thailand. Our results show differently based on the estimation of Tobit model as presented in Table 4.2.5 a. and b. The details are as follows: in terms of economic variables, the household income per month has a positive relationship with FW from vegetables and fruits including their products and oil with a statistical significance (p-value < 0.05 and 0.01). At the same time, the household food expenditure per month affects positively the amount of FW from seasoning as well as from drinks and beverages with a significance level of 0.05 - 0.10. Those results are consistent with the previous literature, such as the study conducted by Florkowski et al (2018), Lusk and Ellison (2017), and Setti et al. (2016) which

state that household income is a factor affecting the amount of FW. Furthermore, Lanfranchi (2016), Parfitt et al. (2010) and Qian et al. (2021) find that people with low household income and low purchasing power will reduce food waste.

The number of family members has a positive impact on the FW from dairy products with a statistical significance (p-value < 0.05), which supports the findings of Tucker and Farrelly (2016) and Mattar et al. (2018) in the sense of tending to waste more food in larger household size. However, the impact of the number of family members on FW from seasoning is still questionable with a significance level of 0.10. Apart from this, the age of the head of household who is mainly in charge of food consumption at home or the head of the household's wife has a negative impact on FW from rice and noodles including their products with a significant level of 0.10. It supports the findings of Florkowski et. al (2018), Lyndhurst et al. (2007), McCarthy and Liu (2017), Parfitt et al. (2010), and Schanes et al. (2018), which reveal that young families (ages between 25-44 years) and children under 16 are more food wasters. At the same time, Lyndhurst et al. (2007) also reveal that old people tend to waste less food than young people. In Particular, Parfitt et al. (2010) found that retirees with limited financial conditions tend to waste less food than young people. However, the impact of age of the head of household on FW from cereal and bread is still questionable with a statistical significance (p-value < 0.10). On the other hand, the number of elderly people in the household also has a positive relationship with FW from seasoning with a statistical significance (p-value < 0.05). This may be because nowadays most elderly people pay more attention to their health, so they attempt to minimize carbohydrates and too sweet or salty food. Apart from this, the number of children also has a negative impact on FW from dairy products with a statistical significance (p-value < 0.10). This may be because dairy products are basically important food for children. Therefore, more children in the family would lead to less FW from dairy products.

The last education of the head of the household has a negative relationship with FW from eggs including eggshells and oil with a statistical significance (p-value < 0.05 and 0.01 respectively). It is consistent with Abeliotis et al. (2016) who argue that the educational level of the head of the household is a factor affecting the amount of FW. On the other hand, the female head of the household gives rise to the amount of FW from rice and noodles including their products, meat including its products, as well as drinks and beverages less than the male head of the household with a statistical significance (p-value < 0.10, 0.05, and 0.01 respectively). It is consistent with Florkowski et al. (2018), which state that the gender of the head of the household is a factor affecting the amount of FW. Additionally, regarding marital

status, single parenthood leads to less amount of FW from eggs including eggshells with a statistical significance (p-value < 0.10). Lastly, the households in urban areas generate FW from vegetables and fruits including their products less than the household in rural areas with a statistical significance (p-value < 0.10). This may be because the households in urban rarely cook by themselves, and they also usually buy ready-to-eat food. Therefore, they buy vegetables in less amount. However, Lebersorger and Schneider (2011) state that people in rural areas waste less food than people in urban areas. Mattar et al. (2018) also insist that people living in rural areas are more religious than people in urban areas, so they avoid food waste and choose to share food with their neighbors.

Moral attitude has a negative relationship with the amount of FW from seasoning as well as drinks and beverages with a statistical significance (p-value < 0.05 and 0.01). It is consistent with the finding of the previous literature. Abdelradi (2018), Aydin and Yildirim (2021), and Barone et al. (2019) reveal that individuals with high moral believe that throwing away food is a mistake and should not be done. Moreover, Attiq et al. (2021), Mattar et al. (2018), Nunkoo et al. (2021), and Yuan et al. (2016) found that the indicators to measure moral attitude are feeling of shame and guilt when disposing food waste and the desire to be an excellent example for families with an attitude of appreciating food. However, the results of our estimated coefficients in the case of seasoning as well as drinks and beverages are still ambiguous. Apart from this, with respect to personal habits, shopping habits, and product characteristics, the results of our estimated coefficients are still ambiguous because showing positives with non-statistically significant results and negatives with statistically significant results respectively.

Table 4.2.4 Reasons for Wasted Food in the Households of SWU Undergraduate Students

a. Personal Habits

Constructs and Measuring Items	Score	St. dev	Category
Food safety (routines in the preparation, handling, and storage of food intended to prevent foodborne illness and injury)	4.00	0.89	Strongly Agree
Inconvenience	3.43	1.08	Agree
Taste dissatisfaction	3.57	1.19	Agree
Not eating what is needed to eat first	3.36	1.17	Agree

Constructs and Measuring Items	Score	St. dev	Category
High frequency of buying food	3.71	1.01	Agree
Lack of cooking skills	3.02	1.31	Agree
Lack of storage knowledge	3.44	1.30	Agree
Preparing/Cooking too much at one time	3.76	1.14	Agree
Errors in serving and storing food	3.11	1.19	Agree
Lack of skills to process leftovers into new food	3.21	1.25	Agree
Throwing leftover food is common for the household members	3.28	1.21	Agree
Confusion between “Best Before Date” and “Use by date”	2.69	1.37	Neutral
Average	**3.38**	**1.23**	**Agree**

b. Shopping Habits

Constructs and Measuring Items	Score	St. dev	Category
Buying food in large quantity	3.88	1.04	Agree
Buying products that are not needed	3.69	1.16	Agree
Buying too many perishables	3.79	1.13	Agree
Lack of planning when shopping	3.67	1.17	Agree
Impulse purchases are usually due to special offers from sellers	3.54	1.16	Agree
Spontaneous purchases because you are interested in the product while in the store	3.61	1.08	Agree
Average	**3.70**	**1.13**	**Agree**

c. Product Characteristics

Constructs and Measuring Items	Score	St. dev	Category
Too large product packaging (not finished in one consumption)	3.77	1.05	Agree
Fresh products with shorter shelf life	3.90	1.00	Agree
Bad quality (easily damaged) packaging	3.59	1.16	Agree
Average	**3.75**	**1.08**	**Agree**

d. Moral Attitude

Constructs and Measuring Items	Score	St. dev	Category
I believe that throwing away food is a mistake.	3.42	1.09	Agree
I believe that throwing away food should not be done.	3.68	1.04	Agree
I have feelings of shame when disposing food waste.	3.60	1.04	Agree
I feel guilty when disposing food waste.	3.67	1.04	Agree
I desire to be an excellent example for families with an attitude of appreciating food.	4.19	0.81	Strongly Agree
Average	**3.71**	**1.04**	**Agree**

Table 4.2.5 The Estimated Tobit of SWU Respondents' Households

a. Estimated Tobit Model for Five Items of FW

Independent variables	Dependent variable (FWaste) FWaste = max(FWaste*, 0)				
	Rice and noodles including their products	Vegetables and Fruits including their products	Meat including its products	Eggs including eggshell	Seasoning
Constant	186.16 (0.02)**	111.84 (0.36)	177.47 (0.18)	235.95 (0.006)***	15.25 (0.77)
Age	-1.89 (0.098)*	-1.03 (0.57)	-1.13 (0.56)	-1.77 (0.16)	0.16 (0.83)
Income	-0.0001 (0.32)	0.0005 (0.01)**	0.000008 (0.71)	0.0002 (0.19)	-0.000009 (0.33)
Expend	0.0003 (0.67)	-0.0019 (0.11)	0.000001 (0.9899)	0.0005 (0.55)	0.001 (0.03)**
FamMember	-1.96 (0.74)	-8.08 (0.39)	9.96 (0.30)	-4.52 (0.48)	-7.66 (0.05)*
Child	-1.22 (0.89)	-1.86 (0.89)	-9.93 (0.47)	7.55 (0.40)	-8.08 (0.16)
Elder	3.96 (0.66)	-9.52 (0.53)	5.62 (0.72)	10.49 (0.31)	10.01 (0.09)*
Edu	0.93 (0.62)	-1.85 (0.54)	-1.38 (0.66)	-4.79 (0.02)**	2.08 (0.11)

Independent variables	Dependent variable (FWaste) FWaste = max(FWaste*, 0)				
	Rice and noodles including their products	**Vegetables and Fruits including their products**	**Meat including its products**	**Eggs including eggshell**	**Seasoning**
Gender_D1	-51.45 (0.00)***	-21.85 (0.37)	-96.65 (0.00)***	-25.22 (0.14)	-8.88 (0.40)
Area_D1	-2.39 (0.87)	-39.35 (0.08)*	-5.7 (0.81)	-20.22 (0.20)	-2.52 (0.80)
Status_D1	-15.09 (0.41)	-47.84 (0.12)	-48.53 (0.13)	-40.82 (0.057)*	-4.55 (0.72)
PersHabit	-3.35 (0.02)**	-1.96 (0.40)	3.58 (0.14)	0.64 (0.69)	-0.26 (0.80)
ShopHabit	1.85 (0.50)	1.45 (0.74)	-4.74 (0.31)	1.16 (0.71)	-0.40 (0.84)
ProdCharac	-4.76 (0.29)	-3.88 (0.59)	-7.86 (0.31)	-13.04 (0.009)***	-5.73 (0.07)*
Attitude	-0.27 $(0.89)^{NS}$	5.88 (0.06)*	-3.79 $(0.26)^{NS}$	-1.27 $(0.56)^{NS}$	-3.92 (0.005)***
Number of Observations	**383**	**385**	**384**	**380**	**385**
S.E. of regression	**66.68**	**100.60**	**139.58**	**83.61**	**31.18**
Log likelihood	**-1,225.90**	**-1,249.82**	**-1,647.08**	**-1,430.21**	**-747.29**

b. Estimated Tobit Model for Five Items of FW

Independent variables	Dependent variable (FWaste) FWaste = max(FWaste*, 0)				
	Soup and curry	**Dairy products**	**Drinks and beverages**	**Oil**	**Cereal and bread**
Constant	116.53 (0.41)	-847.16 (0.04)**	41.64 (0.84)	-71.27 (0.58)	-787.39 (0.008)***
Age	-0.29 (0.89)	5.45 (0.35)	1.78 (0.55)	2.28 (0.23)	8.48 (0.04)**
Income	-0.0002 (0.29)	0.000007 $(0.90)^{NS}$	-0.0003 (0.36)	0.0007 (0.00)***	-0.0003 (0.47)
Expend	0.0003 (0.83)	-0.0005 (0.88)	0.003 (0.06)*	0.002 (0.15)	0.0001 (0.95)

Independent variables	Dependent variable (FWaste) FWaste = max(FWaste*, 0)				
	Soup and curry	**Dairy products**	**Drinks and beverages**	**Oil**	**Cereal and bread**
FamMember	3.81 (0.71)	60.93 (0.04)**	-11.10 (0.50)	-11.53 (0.23)	-5.26 (0.81)
Child	-8.98 (0.54)	-106.08 (0.05)*	-14.95 (0.49)	12.20 (0.33)	-2.25 (0.94)
Elder	-0.40 (0.98)	12.02 (0.80)	35.03 (0.13)	-10.46 (0.47)	0.55 (0.99)
Edu	-4.69 (0.17)	-5.71 (0.52)	1.33 (0.78)	-7.71 (0.009)***	8.27 (0.21)
Gender_D1	24.75 (0.38)	-72.29 (0.33)	-68.38 (0.08)*	16.85 (0.4971)	35.18 (0.51)
Area_D1	7.17 (0.78)	119.70 (0.11)	14.94 (0.68)	-20.30 (0.36)	4.01 (0.93)
Status_D1	-18.70 (0.58)	9.51 (0.92)	-48.34 (0.32)	-18.92 (0.53)	-7.27 (0.91)
PersHabit	1.25 (0.64)	-2.49 (0.74)	-4.44 (0.24)	-1.47 (0.52)	-4.0582 (0.4208)
ShopHabit	-4.49 (0.37)	-9.65 (0.49)	-11.21 (0.12)	4.03 (0.37)	0.31 (0.97)
ProdCharac	6.07 (0.46)	-10.26 (0.66)	1.72 (0.88)	-12.92 (0.08)*	-16.26 (0.30)
Attitude	1.41 (0.69)	5.89 (0.55)	-10.77 (0.04)**	0.08 (0.98)	5.89 (0.37)
Number of Observations	**383**	**385**	**383**	**385**	**384**
S.E. of regression	**190.46**	**103.38**	**105.41**	**85.64**	**52.88**
Log likelihood	**-2,093.63**	**-388.88**	**-808.22**	**-1,012.38**	**-372.68**

Note: The figure in parenthesis means *p*-value of z-statistics. The asterisk *, **, and *** denoted statistically significant results at 0.10 level (the *p*-value < 0.10), 0.05 ((the *p*-value < 0.05) and 0.01 level (the *p*-value < 0.01), respectively.

(2) Case Study of UGM Undergraduate Students' Households

The respondents in this study are the head of the households who are in charge of food consumption at home or the wives of the household heads. Most of the respondents are female (92.68 %), married (88.89%), and living in urban areas (54.29%) (Table 4.2.6 a.). The average age is 50 years, with the minimum age 27 years and maximum age 83 years. To note, the head of household respondent who is 27 years old was the oldest brother/sister of the student, while the student's parents are elderly and no longer responsible for household consumption. The majority of formal education is senior high school with an average of 13.67 years. The average number of household members is 4 persons, with the average number of children (< 17 years old) and elderly people (> 60 years old) in the household is 1 person. Regarding economic characteristics, the average household income, expenditure, and food expenditure are 5,905,457 IDR per month, 3,861,363 IDR per month, and 2,277,146 IDR per month respectively. In addition, 58.97% of household expenditure is allocated to food expenditure (Table 4.2.6 b.).

The results of 24-hour recall survey of FW in the households of UGM undergraduate students show the top five of most frequently discarded food types, namely oil, eggs including eggshells, vegetables and fruits including their products, rice, and noodles including their products, and meat including its products. The details are as follows: 53.28% of households generate FW from oil, 45.45% from eggs including eggshells, 44.70% from vegetables and fruits including their products, 41.92% from rice and noodles including their products, and 40.66% from meat including its products.

In oil group, the most wasted category comes from meal leftovers of 87.68%, which is the used oil that is left in the pans after frying chicken, egg, fish and other types of side dishes. In eggs including eggshell group, the most wasted category is from partly used food at 70.56%, including eggs that are disposed after it has been partly used (eggshell). In vegetables and fruits group including their products, the most wasted category is meal leftovers amounting 44.63% from the cooked vegetables left on the plate or in the pan. In rice and noodles group including their products, the most wasted category is also meal leftovers as much as 54.22% from rice left on the plate and noodles left in the bowl. In meat group including its products, the most wasted category comes from meal leftovers amounting 56.52% from leftover meat and fish or chicken bones on the plate (Table 4.2.7). Furthermore, the information from FGD with the head of the household of UGM undergraduate students is consistent with the survey

results. The type of food that is most often wasted is used oil or in Indonesia it is called "*jelantah*", which is used oil from frying fish, chicken, eggs, and other side dishes. Oil is one of the significant ingredients in cooking which cannot be avoided. The amount of oil used when frying food also determines the taste and texture of the food, in which the more the amount of oil used, the more savory and crunchier the food will be. However, the oil can only be used once or twice, and if there is still leftover, it will be thrown away because used oil can cause disease and be detrimental to health.

Furthermore, if we observe the results of the previous studies in the cases of several countries, there are differences regarding the main sources of FW. In Finland, the largest contributor of FW comes from vegetables, cooked food, and milk (Silvennoinen et al., 2014). In Hungary and Spain, most FW consists of bakery, beef, fish, and animal fat (Szabó-Bódi et al., 2018). In Hongkong, most FW comes from fruit and vegetables group (Zan et al., 2018). In terms of the amount of FW in household, the top five FW items consist of eggs including eggshells, vegetables and fruits including their products, meat including its products, oil, as well as drinks and beverages. The contribution of each food group to the total amount of FW in household is 19.30%, 16.65%, 13.43%, 12.86%, and 10.22% respectively (Table 4.2.8). It can be seen that although oil ranks first in the most frequently discarded food types, the amount of FW is lower than other types of food including eggs including eggshell, vegetables and fruits including their product, and meat including its product. This is because the amount of oil that is wasted is only in small amount in which the remaining oil used for frying the side dishes is 43.14 ml/day/household, while the amount of FW in the food groups of eggs including eggshell, vegetables and fruits including their products, and meat including its product is higher, namely 64.77 gr, 55.87 gr, and 45.08 gram per day per household respectively (Table 4.2.8). The egg group including eggshells ranks first in the type of food that is most often thrown away because the eggshell cannot be consumed and/or usually used for animal/pet feed. Furthermore, in the second place is vegetables and fruits group including their products because of their characteristic which is easily damaged, and several types of vegetables cannot be reheated because they will generate negative impacts on health, for example, spinach and water spinach.

The estimate of the economic value of FW in each UGM undergraduate student household is IDR 467.10 (0.045 USD) per day or equivalent to IDR 170,491.32 (16.42 USD) per year. Furthermore, if we estimate the value of FW for the entire population of UGM

undergraduate students, a FW value of IDR 5,474,646,930.65 (527,315.95 USD) per year is obtained. This value is shown as wasted due to the FW behavior, while there are still many Indonesian people who cannot even fulfill their food needs properly as a result of poverty. Based on the five highest order of FW amount, the FW value for each food group can be estimated as follows: Eggs including eggshells, vegetables and fruits including their products, meat including its products, oil, and drink and beverages account for IDR 1,056,719,757.12 (101,782.85 USD), IDR 911,516,640.89 (87,796.94 USD), IDR 735,478,256.15 (70,840.99 USD), IDR 703,827,239.8 (67,792.38 USD), and IDR 509,189,804.22 (49,044.97 USD) per year respectively (Table 4.2.8). The large amount of FW in each food group also determines the value of FW.

Table 4.2.6 Characteristics of the Households of UGM Respondents

a. Qualitative Variables

Category / Attribute	Number of Respondents	Percent / Average
Gender	**396**	**100.00%**
Male	29	7.32%
Female	367	92.68%
Marital status	**396**	**100.00%**
Single	2	0.51%
Married	352	88.89%
Widowed	42	10.61%
Geographic area	**396**	**100.00%**
Rural area	215	54.29%
Urban area	181	45.71%

b. Quantitative Variables

Category / Attribute	Mean	Min	Max	Std. dev
Age	49.99	27	83	6.56
Education	13.67	6	22	2.98

Category / Attribute	Mean	Min	Max	Std. dev
Household members	4.29	2	8	1.07
Children (< 17 years old) in household	0.61	0	4	0.79
Elderly people (> 60 years old) in household	0.30	0	4	0.60
Household income (Idr/month)	5,905,457.07	500,000	50,000,000	6,515,366.94
Household expenditure (Idr/month)	3,861,363.64	300,000	35,000,000	3,370,273.54
Household food expenditure (Idr/month)	2,277,146.46	200,000	50,000,000	3,084,463.18

Table 4.2.7 Categories of 24-Hour Recall of Food Waste in the Household of UGM Undergraduate Students

Food waste item	Percent of respondents	Categories of food waste (Percent of respondents)				
		Completely unused foods	Partly used foods	Meal leftovers	Leftovers after storing meals	Total
Rice and noodles including their products	41.92%	7.23%	25.30%	54.22%	13.25%	**100%**
Vegetables and Fruits including their product	44.70%	6.78%	30.51%	44.63%	18.08%	**100%**
Meat including its products	40.66%	4.35%	32.30%	56.52%	6.83%	**100%**
Eggs including eggshell	45.45%	2.78%	70.56%	22.22%	4.44%	**100%**
Seasoning	26.26%	6.73%	4.81%	60.58%	27.88%	**100%**
Soup and curry	30.30%	3.33%	22.50%	60.83%	13.33%	**100%**
Dairy products	15.91%	7.94%	17.46%	49.21%	25.40%	**100%**
Drinks and beverages	31.06%	4.88%	19.51%	61.79%	13.82%	**100%**

Food waste item	Percent of respondents	Categories of food waste (Percent of respondents)				
		Completely unused foods	Partly used foods	Meal leftovers	Leftovers after storing meals	Total
Oil	53.28%	2.84%	2.37%	87.68%	7.11%	**100%**
Cereal and bread	11.62%	8.70%	15.22%	30.43%	45.65%	**100%**

Table 4.2.8 Estimation Results of Amount and Value of Food Waste in the Households of UGM Undergraduate Students

Food Waste Item	Estimated Amount of Food Waste (gram(ml)/ household/ day)	Estimated Amount of Food Waste (kg/ capita/ year)	Estimated Value of Food Waste (IDR/ household/ year)	Estimated Value of Food Waste (IDR/total number of households of UGM undergraduate students/year)	Estimated Value of Food Waste (USD/total number of households of UGM undergraduate students/year)
Rice and noodles including their products	31.21	2.28 (9.30%)	15,857.18	509,189,804.22	49,044.97
Vegetables and Fruit including their product	55.87	4.08 (16.65%)	28,386.43	911,516,640.89	87,796.94
Meat including its products	45.08	3.29 (13.43%)	22,904.25	735,478,256.15	70,840.99
Eggs including eggshell	64.77	4.73 (19.30%)	32,908.34	1,056,719,757.12	101,782.85
Seasoning	9.96	0.73 (2.97%)	5,060.48	162,496,970.52	15,651.65
Soup and curry	18.91	1.38 (5.64%)	9,607.79	308,515,834.60	29,716.13
Dairy products	9.97	0.73 (2.97%)	5,065.56	162,660,120.09	15,667.36
Drinks and beverages	34.3	2.50 (10.22%)	17,427.14	559,603,020.98	53,900.75

Food Waste Item	Estimated Amount of Food Waste (gram(ml)/ household/ day)	Estimated Amount of Food Waste (kg/ capita/ year)	Estimated Value of Food Waste (IDR/ household/ year)	Estimated Value of Food Waste (IDR/total number of households of UGM undergraduate students/year)	Estimated Value of Food Waste (USD/total number of households of UGM undergraduate students/year)
Oil	43.14	3.15 (12.86%)	21,918.57	703,827,239.80	67,792.38
Cereal and bread	22.35	1.63 (6.66%)	11,355.59	364,639,286.27	35,121.92
Total	**335.56**	**24.50 (100.00%)**	**170,491.32**	**5,474,646,930.65**	**527,315.95**

Note: More detailed calculation can be seen in the part of Method and Procedure of Chapter 2.

This study also examines the reasons for FW behavior in the households of UGM undergraduate students based on four criteria, namely personal habits, shopping habits, product characteristics, and moral attitude. In personal habits criteria, the average score is in the neither agree nor disagree (neutral) category, with a standard deviation value of 1.08. The personal habits criteria has twelve statement indicators with nine indicators getting neutral responses and one indicator getting strongly agree, agree, and disagree responses. The households of UGM undergraduate students strongly agree with the reason for disposing food due to food safety (routines in the preparation, handling, and storage of food intended to prevent foodborne illness and injury) and give an agreeing response to the reasons for the inconvenience. The results of this survey are strengthened by the information collected from the FGDs with parents of UGM undergraduate students. They stated that the reason for FW behavior was due to the lack of activity in planning, preparing, and storing food ingredients which resulted in food being easily spoiled. In addition, the respondents gave neutral responses to eight indicators of personal habits, namely taste dissatisfaction, not eating what needs to eat first, high frequency of buying food, lack of storage knowledge, preparing/cooking too much at one time, errors in serving and storing food, lack of skills to process leftovers into new food, throwing leftover food is common for the household members, and confusion between “Best Before Date” and “Use by date” (Table 4.2.9 a).

Regarding shopping habits reasons, household respondents from UGM undergraduate students gave responses falling in the category of neither agree nor disagree (neutral), with the standard deviation of 1.11. If explored further, all indicators of shopping habits fall into neutral

response category, including the indicators of buying food in large quantity, buying products that are not needed, buying too many perishables, lack of planning when shopping, impulse purchases due to special offers from sellers, and spontaneous purchases because interested in the product while in the store. The six indicators have a rather high standard deviation ranging from 1.02 to 1.15 (Table 4.2.9 b). The information from the FGD strengthens the survey results. UGM undergraduate students' households confirmed that one of the reasons for FW behavior was due to impulsive buying, lack of planning, and spontaneous purchases. However, they can anticipate it by making notes before shopping, bringing enough money while shopping, and buying things as needed.

Another factor that causes households to dispose more FW is related to product characteristics. The average score for product characteristics falls in the Agree category with the standard deviation of 1.02. Two indicators on product characteristics variables have agree responses, namely the reason for disposing FW because it is fresh products with shorter shelf life and bad quality (easily damaged) packaging. Another indicator that is the reason of too large product packaging (not finished in one consumption) has neutral response (Table 4.2.9 c). The FGD results also stated that some products that had shorter shelf life and are not supported by proper storage would be easily damaged or expired, so they had to be discarded.

Moreover, the households of UGM undergraduate students gave a strongly agree response to the moral attitude variable with the standard deviation of 0.73. Tracing each indicator, it can be seen that four indicators have strongly agree responses, namely they believe that throwing away food is a mistake and should not be done. They also strongly agree that they feel guilty when disposing FW and they desire to be an excellent example for families with an attitude of appreciating food. In addition, the indicator that they have feeling of shame when disposing FW gets an affirmative response. The standard deviation values for all indicators on the moral attitude variable vary from 0.66 to 0.85 (Table 4.2.9 d). The FGD results also informed that moral reasons such as feeling of guilt, feeling of shame, and the belief that it is not good to waste food are the factors inhibiting FW behavior.

In this study, FW consists of ten components, namely rice and noodles, vegetables and fruits, meat, eggs, seasoning including its products, soup and curry, dairy products, drinks and beverages, oil and cereal, and bread. Tables 4.2.10a and 4.2.20b show that age has a negative effect on meat, including its products (the p-value <0.10). Research by Lyndhurst et al. (2007) also shows that older people waste less food than young people. Meat, including its products,

is more expensive than other food components, so the older you are, the more you understand this high value. Income does not affect FW (the p-value > 0.10), unlike Florkowski et al. (2018); Lusk and Ellison (2017), Lanfranchi (2016); Parfitt et al. (2010); Qian et al. (2021); Setti et al. (2016). Most of the respondents (80%) have income above the minimum wage (Rp. 2,126,755), and only 99% of family heads are married.

Personal habits decrease FW from rice and noodles, including their products, vegetables and fruits, including their products and dairy products (the p-value <0.05). This does not align with the research of Ananda et al. (2021); Bravi et al. (2020); Lanfranchi (2016); Priefer et al. (2016); Zan et al. (2018). It is because food safety is vital, and households should consume food immediately, and they will not re-cook the leftover food because they feel uncomfortable with it, thus reducing the amount of household FW. Shopping habits also diminish meat, including their products FW (the *p*-value < 0.05), which is also different the research results of Aydin and Yildirim (2021); Bravi et al. (2020); Koivupuro et al. (2012; Nunkoo et al. (2021); and Soma et al. (2021). The households are still unsure whether they have carried out responsible shopping habits, but they have excellent planning to reduce meat FW, which records higher value than other food ingredients. Product characteristics do not significantly affect FW (the *p*-value <0.05) because the households have the same understanding that food ingredients consumed have a shorter shelf life and bad-quality packaging, which does not follow the research of Aka and Buyukdag (2021) and Lanfranchi (2016). In contrast, according to the research results, moral attitude negatively affects rice and noodles FW, including their products and soup and curry FW (Abdelradi, 2018; Aydin & Yildirim, 2021; Barone et al., 2019).

Table 4.2.9 Reasons for Wasted Food in the Households of UGM Undergraduate Students

a. Personal Habits

Constructs and measuring items	Score	St. dev	Category
Food safety (routines in the preparation, handling, and storage of food intended to prevent foodborne illness and injury)	4.26	0.74	Strongly Agree
Inconvenience	3.58	1.03	Agree
Taste dissatisfaction	2.79	1.14	Neutral
Not eating what is needed to eat first	2.74	1.04	Neutral
High frequency of buying food	2.50	1.11	Neutral

Constructs and measuring items	Score	St. dev	Category
Lack of cooking skills	2.07	0.97	Disagree
Lack of storage knowledge	2.60	1.11	Neutral
Preparing/Cooking too much at one time	2.99	1.17	Neutral
Errors in serving and storing food	2.76	1.14	Neutral
Lack of skills to process leftovers into new food	2.93	1.19	Neutral
Throwing leftover food is common for the household members	2.31	1.16	Neutral
Confusion between “Best Before Date” and “Use by date”	2.93	1.16	Neutral
Average	**2.87**	**1.08**	**Neutral**

b. Shopping Habits

Constructs and measuring items	Score	St. dev	Category
Buying food in large quantity	2.82	1.14	Neutral
Buying products that are not needed	2.51	1.02	Neutral
Buying too many perishables	2.69	1.07	Neutral
Lack of planning when shopping	2.76	1.11	Neutral
Impulse purchases are usually due to special offers from sellers	2.80	1.15	Neutral
Spontaneous purchases because you are interested in the product while in the store	2.89	1.15	Neutral
Average	**2.74**	**1.11**	**Neutral**

c. Product Characteristics

Constructs and measuring items	Score	St. dev	Category
Too large product packaging (not finished in one consumption)	2.78	1.03	Neutral
Fresh products with shorter shelf life	3.63	0.95	Agree
Bad quality (easily damaged) packaging	3.04	1.07	Agree
Average	**3.15**	**1.02**	**Agree**

d. Moral Attitude

Constructs and Measuring Items	Score	St. dev	Category
I believe that throwing away food is a mistake.	4.30	0.67	Strongly Agree
I believe that throwing away food should not be done.	4.19	0.79	Strongly Agree
I have feeling of shame when disposing food waste.	3.93	0.85	Agree
I feel guilty when disposing food waste.	4.28	0.67	Strongly Agree
I desire to be an excellent example for families with an attitude of appreciating food.	4.45	0.66	Strongly Agree
Average	**4.23**	**0.73**	**Strongly Agree**

Table 4.2.10 The Estimated Tobit Model of UGM Respondents' Households

a. Estimated Tobit Model for Five Items of FW

Independent variables	Dependent variable (FWaste) FWaste = max(FWaste*, 0)				
	Rice and noodles including their products	Vegetables and Fruit including their products	Meat including its products	Eggs including eggshell	Seasoning
Constant	72.99 (0.33)	145.56 (0.19)	80.43 (0.37)	96.95 (0.55)	-4.80 (0.99)
Age	-0.21 (0.83)	-0.23 (0.88)	-2.31 (0.06)*	-2.00 (0.36)	-0.04 (0.98)
Income	7.68E-07 (0.53)	2.85E-06 (0.12)	-9.05E-07 (0.56)	-1.90E-06 (0.51)	-3.52E-06 (0.17)
Expend	-8.63E-07 (0.73)	-3.70E-06 (0.33)	1.69E-06 (0.58)	-1.61E-06 (0.77)	1.22E-05 (0.00)***
FamMember	16.02 (0.01)**	1.97 (0.83)	-2.15 (0.78)	-8.80 (0.52)	-14.16 (0.19)
Child	7.87 (0.35)	-7.77 (0.56)	-0.91 (0.93)	2.91 (0.87)	6.64 (0.62)
Elder	13.38 (0.20)	-4.81 (0.77)	-9.63 (0.47)	24.82 (0.29)	19.82 (0.24)
Edu	0.32 (0.88)	2.14 (0.53)	2.14 (0.42)	0.63 (0.89)	-2.10 (0.55)

Independent variables	Dependent variable (FWaste) FWaste = max(FWaste*, 0)				
	Rice and noodles including their products	**Vegetables and Fruit including their products**	**Meat including its products**	**Eggs including eggshell**	**Seasoning**
Gender_D1	6.30 (0.79)	-32.32 (0.35)	33.71 (0.25)	22.50 (0.66)	38.64 (0.34)
Area_D1	-27.39 (0.02)**	-4.20 (0.82)	3.70 (0.80)	4.61 (0.86)	-14.83 (0.46)
Status_D1	51.48 (0.55)	-1,092.14 (1.00)	-1.51 (0.99)	80.17 (0.66)	960.87 (1.00)
PersHabit	-5.91 (0.00)***	-6.06 (0.02)**	0.55 (0.78)	-0.08 (0.86)	-0.05 (0.98)
ShopHabit	3.16 (0.22)	5.61 (0.15)	-6.31 (0.04)**	-6.84 (0.67)	1.95 (0.63)
ProdCharac	-0.37 (0.93)	-8.45 (0.19)	3.98 (0.43)	-2.76 (0.98)	-9.23 (0.17)
Attitude	-5.03 (0.01)**	-3.04 (0.31)	-0.01 (0.10)	4.73 (0.26)	-4.96 (0.11)
Number of Observations	**396**	**396**	**396**	**396**	**396**
S.E. of regression	**56.39**	**88.37**	**59.92**	**131.43**	**67.49**
Log likelihood	**-1,134.93**	**-1,287.26**	**-1,149,10**	**-1,362.28**	**-772.26**

b. Estimated Tobit Model for Five Items of FW

Independent variables	Dependent variable (FWaste) FWaste = max(FWaste*, 0)				
	Soup and curry	**Dairy products**	**Drinks and beverages**	**Oil**	**Cereal and bread**
Constant	-105.18 (0.23)	-56.57 (0.78)	-339.53 (0.13)	-6.86 (0.95)	388.54 (0.33)
Age	-0.75 (0.55)	-1.02 (0.72)	-1.80 (0.56)	-0.92 (0.55)	-0.63 (0.91)
Income	-2.87E-06 (0.12)	3.66E-06 (0.19)	-2.90E-06 (0.48)	4.02E-07 (0.83)	-9.48E-06 (0.28)
Expend	4.08E-06 (0.18)	4.98E-06 (0.37)	-2.20E-06 (0.79)	9.96E-07 (0.79)	2.14E-05 (0.11)

Independent variables	Dependent variable (FWaste) FWaste = max(FWaste*, 0)				
	Soup and curry	**Dairy products**	**Drinks and beverages**	**Oil**	**Cereal and bread**
FamMember	9.25 (0.22)	-15.26 (0.40)	-18.57 (0.35)	21.65 (0.02)**	-93.24 (0.02)**
Child	-6.64 (0.50)	8.62 (0.70)	-14.01 (0.61)	-5.79 (0.65)	-50.88 (0.33)
Elder	-10.23 (0.41)	-32.05 (0.32)	-13.23 (0.70)	-9.20 (0.58)	-57.48 (0.39)
Edu	8.81 (0.00)***	0.37 (0.95)	-8.11 (0.21)	2.37 (0.48)	7.79 (0.52)
Gender_D1	5.95 (0.83)	76.33 (0.27)	-105.13 (0.11)	-48.35 (0.15)	-86.58 (0.43)
Area_D1	-30.88 (0.03)**	21.31 (0.51)	3.13 (0.93)	-46.70 (0.01)**	-85.33 (0.20)
Status_D1	-815.02 (1.00)	-1,246.95 (1.00)	-1,814.04 (1.00)	1,204.83 (1.00)	-2,458.48 (1.00)
PersHabit	1.79 (0.35)	-8.10 (0.06)*	-3.83 (0.45)	1.46 (0.56)	-13.77 (0.11)
ShopHabit	-0.63 (0.83)	-2.91 (0.67)	-5.27 (0.50)	-0.28 (0.94)	17.35 (0.19)
ProdCharac	-8.52 (0.09)*	0.96 (0.93)	2.52 (0.84)	-5.63 (0.37)	-25.47 (0.23)
Attitude	-4.71 (0.04)**	2.20 (0.67)	1.99 (0.74)	-2.53 (0.38)	-13.35 (0.21)
Number of Observations	**396**	**396**	**396**	**396**	**396**
S.E. of regression	**48.81**	**72.46**	**139.79**	**108.24**	**90.98**
Log likelihood	**-856.55**	**-517.39**	**-988.51**	**-1,484.65**	**-417.61**

Note: The figure in parenthesis means *p*-value of z-statistics. The asterisk *, **, and *** denoted statistically significant results at 0.10 level (the *p*-value < 0.10), 0.05 ((the *p*-value < 0.05) and 0.01 level (the *p*-value < 0.01), respectively.

4.3 Food Consumption Management

(1) Case Study of SWU Undergraduate Students' Households

The results of food consumption management in the case of households of SWU undergraduate students are divided into six aspects: (i) Planning, (ii) Provision, (iii) Preparation, (iv) Serving/Processing, (v) Storage, and (vi) Food Waste Disposal/Utilization. The details of each part are as follows. Again, the respondents are the heads of households who are mainly in charge of food consumption at home or the wives of the heads of household. Firstly, the average scores of the variable of Planning on food consumption management reflect that the respondents fall into the very good category. This is because they agree with eight indicators, namely Making menu plans for a certain period, Checking the stock in the refrigerator before making the shopping list, Making a shopping list according to the needs, Combining the number of items to be purchased to avoid overspending, Making a shopping list and consistently follow the list when shopping, Having adequate storage space so that the food I store lasts longer, Shopping according to the capacity of my food storage, and reducing leftovers, they plan to buy less food. Within eight categories, the eighth (Reducing leftovers, they plan to buy less food) and sixth (Having adequate storage space so that the food I store lasts longer) show rather high scores (3.90 and 3.87 respectively), while the first one (Making menu plans for a certain period) presents the lowest score (3.39). In addition, households strongly agree that they will adjust the quantity of cooked food according to the number of present family members (Table 4.3.1).

With respect to the average scores of the variables of the management of provision food to consume, the respondents fall into the very good category. This is because they strongly agree with cooking the ingredients available in the refrigerator before buying more as well as buying groceries/cooked food at the traditional market. Meanwhile, they also agree with four indicators, namely Buying groceries/cooked food at a mobile vegetable vendor/food truck, Buying groceries/cooked food at the shop, Buying groceries/cooked food at the mini market, and Buying groceries/cooked food at the supermarket. Within these categories, the last one shows the highest average score (3.94). On the other hand, they neither agree nor disagree with buying groceries/cooked food online, however, its standard deviation is rather high (1.31) (Table 4.3.2). Up to now, the average score of the variable of Preparing food for the consumption implies that the respondents belong to the good category. Surprisingly, they agree with only one indicator, namely if there are guests, I will provide enough food that they need,

or in other words, I have never followed the principle of “it’s better to have leftovers than serving less food”. On the other hand, they neither agree nor disagree with three indicators, namely in the food preparation process, I usually use existing ingredients, I am used to cooking for the amount my family needs, and I don’t throw away fruits or vegetables with holes or not smooth. However, their standard deviations are rather high (1.17 - 1.25) (Table 4.3.3).

The average scores of the variable of Serving/Processing imply that the respondents belong to the very good category. This is because they strongly agree that if there are leftovers, their family usually eats them either in the same form or reheated. Moreover, they agree with ten indicators, namely Before re-consumed, the leftover food will be processed into new food by adding other ingredients, Feeling comfortable when processing leftovers, Feeling comfortable when I eat decent leftovers, If I have leftover rice, I will process it into fried rice or other forms of food, I can adjust my cooking plan by taking into account the leftovers I have at home, My kids love home food so the food I cook is rarely left, I don't buy food from outside if the food at home has not been consumed, and When I already cook, other family members eat at home, I can eat the same food consecutively in one day, as well as Understanding that eating leftovers that are still decent doesn't have bad effects on health. Within these categories, the average scores of two indicators: If I have leftover rice, I will process it into fried rice or other forms of food as well as My kids love home food so the food I cook is rarely left, are rather high (3.98 and 3.95). On the other hand, the respondents neither agree nor disagree with two indicators, namely I rarely forget to keep leftovers in the refrigerator until they go stale, and If I have fruit that is too ripe, I will process it into jam or other processing. However, their standard deviations are rather high (1.32 and 1.28) (Table 4.3.4).

Regarding the average values of the variable of storage, the respondents fall into the very good category. This is because they agree with five indicators, namely Arranging food by expiration date, Eating food before its quality decreases, Checking/Knowing when the food is about to be expired, Keeping leftovers in the fridge to use again and they are rarely forgotten because I consume them later, and The food that I keep in the refrigerator is rarely forgotten even though the refrigerator is messy and full. The first three categories show high average scores (3.89, 3.87, and 3.86). On the other hand, the respondents neither agree nor disagree with Labeling food purchase dates for food that doesn’t have an expiry date and Labeling the expiry date of the food I keep in the refrigerator. However, their standard deviations are rather high (1.22 and 1.20) (Table 4.3.5).

Lastly, the average score of the variable of Food Waste Disposal/Utilization on Food Consumption Management implies that the respondents belong to the very good category. This is because they agree with four indicators, namely If I have excess food (buy/given) I will share it with neighbors/friends/relatives, If I cook too much, I will share the food with neighbors/friends/relatives, I will give leftovers to other people if they are intact and decent, and I will use the food leftovers to feed pets/livestock. Especially, the two first categories show rather high average scores (3.97 and 3.94 respectively). Meanwhile, the respondents neither agree nor disagree with two indicators, namely I accidentally cook more so that the rest can be given to the pets, and I will process the leftovers into compost/liquid fertilizer. However, their standard deviations are rather high (1.39 and 1.41) (Table 4.3.6)

The above results from the online survey are consistent with the information from in-depth interviews. Regarding the planning, the respondents will adjust the quantity of cooked food according to the number of family members present. Especially, before they cook at home, they will ask their children what food they would like to eat on that particular day or whether they eat at home or not. They also propose that planning before shopping, cooking, and eating is very important to reduce the amount of FW. It supports the finding of Babbitt et al., (2021) which state that there is a positive correlation between food planning activities and a decrease in household food waste. On the other hand, the indicator of making a shopping list and consistently following the list when shopping shows a rather low score. It should be asserted as the factor of increasing FW in their household because Ponis et al., (2017) found that shopping behavior outside the shopping list would increase the number of food purchases so households tend to throw away more food.

Unsurprisingly, with respect to the variable of provision, the indicator of buying groceries/cooked food online shows very low score, while buying them at the traditional groceries and supermarket present very high score. It is consistent with the information from in-depth interviews that some respondents prefer to shop food at convenience stores, namely MAKRO and TESTCO LOTUS. However, Minten and Reardon, (2008) address that the difference in the quality and price of goods is higher in supermarkets than in traditional markets, which affects household shopping preference. Apart from that, the indicator of I have never followed the principle of “it’s better to have leftovers than serving less food” shows the highest average scores when compared with the other indicators in the variable of food preparation management. It is also consistent with the information from in-depth interviews. It

could be linked to FW reduction as Stangherling et al's. (2020) concern on the impact of social norms on FW reduction.

With respect to the serving/processing and storage variables, the households of SWU fall into the very good category because they know well about recooking leftovers and arranging food by expiration date. These are consistent with the information from in-depth interviews that most respondents are not confused with "Best Before Date (BBF)" and "Use by date". The knowledge about recooking leftovers could be linked to FW reduction that Babbitt et al. (2021) and Schanes et al. (2018) state that households that regularly consume or process leftover food will produce less food waste. On the other hand, Gojard et al., (2021) state that food labels related to information on use dates and expiration dates are important because they are the primary consideration in food storage. Besides, in terms of FW disposal/utilization, most respondents in the in-depth interview session sort the FW before throwing it into the public rubbish bin. It could be linked to the FW reduction. Secondi et al., (2015) also state that disposing /utilizing food scraps by sorting and composting activities could reduce the amount of food waste. Apart from this, most respondents also know well about the concept of FW management, i.e., Knowledge about putting eggshells on the clay to support tree growth, Feeding the pets with FW, and Sharing leftovers with the motorcycle taxi riders. It is also supported by Nguyen et al., (2022) who propose three main activities at the stage of disposing/utilizing food waste, namely giving it to livestock, processing into household compost, and sorting food waste in organic waste bins.

In sum, only one variable, the preparing food consumption management, implies that the heads of households who are mainly in charge of food consumption at home or the wives of the heads of households in the case of SWU belong to the good category. The rest variables, which consist of Planning, Provision, Serving/Processing, Storage, and Food Waste Disposal/ Utilization imply that the respondents reserve the very good category. The main results are in line with the theme of literature in the case of Thailand where most respondents had moderate to high knowledge of waste management, namely waste management behavior at the community or household level in the cases of Nan Province (Maruean et al., 2013), Lamphun Province (U-chupaj, 2018), and Phitsanulok Province (Khongpirun et al., 2017; Thabpadung, 2020). Also, the case of provinces in the northeastern region including Bueng Kan Province (Sriyothee, 2020) and Mahasarakham Province (Khaeongmueang, 2019). Meanwhile, the case of provinces in the central and southern region involves Samut Songkram Province (Jeamponk, 2012) and Nakhon Si Thammarat (Kirdklinhom, 2019). The above results also support the

conceptual model of food waste reduction in Thailand proposed by Srijuntrapun (2016) and Bunditsakulchai and Liu (2021). It consists of seven stages: Pre-shopping planning, Shopping, Storage and preservation, Cooking, Eating habits, Processing of leftovers, and Food waste recycling.

Table 4.3.1 Food Consumption Management Planning in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
I make menu plans for a certain period (e.g., daily plan, weekly plan).	3.39	1.09	Agree
I will check the stock in the refrigerator before making the shopping list.	3.77	0.96	Agree
I will make a shopping list according to my needs.	3.70	1.01	Agree
I combine the number of items to be purchased to avoid overspending.	3.78	1.01	Agree
I make a shopping list and consistently follow the list when shopping.	3.54	1.03	Agree
I have adequate (decent) storage space so that the food I store lasts longer.	3.87	0.87	Agree
I will shop according to the capacity of my food storage (e.g., refrigerator or other storage space).	3.76	1.02	Agree
To reduce leftovers, I plan to buy less food.	3.90	0.87	Agree
I will adjust the quantity of cooked food according to the number of family members present.	4.27	0.73	Strongly Agree
Average	**3.77**	**0.98**	**Agree (Very good)**

Table 4.3.2 Food Consumption Management Provision in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
I will cook the ingredients available in the refrigerator before buying more.	4.25	0.79	Strongly Agree
I buy groceries/cooked food at a mobile vegetable vendor/food truck.	2.92	1.26	Agree
I buy groceries/cooked food at the shop.	3.22	1.23	Agree

Constructs and Measuring Items	Score	St. dev	Category
I buy groceries/cooked food at the traditional market.	4.22	0.78	Strongly Agree
I buy groceries/cooked food at the mini market.	3.43	1.22	Agree
I buy groceries/cooked food at the supermarket.	3.94	1.10	Agree
I buy groceries/cooked food online.	2.26	1.31	Neutral
Average	**3.46**	**1.30**	**Agree (Very good)**

Table 4.3.3 Food Consumption Management Preparation in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
In the food preparation process, I usually use existing ingredients.	2.27	1.17	Neutral
I am used to cooking for the amount my family needs.	2.56	1.22	Neutral
If there are guests, I will provide enough food that they need. (I have never followed the principle of "it's better to have leftovers than serving less food").	3.43	1.11	Agree
I don't throw away fruits or vegetables with holes or not smooth.	2.93	1.25	Neutral
Average	**2.79**	**1.26**	**Neutral (Good)**

Table 4.3.4 4 Food Consumption Management Serving/Processing in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
If there are leftovers, our family usually eats them either in the same form or reheated.	4.15	0.82	Strongly Agree
Before being eaten again, the leftover food will be processed into new food by adding other ingredients.	3.67	1.09	Agree
I feel comfortable when processing leftovers.	3.68	1.04	Agree
I feel comfortable when I eat decent leftovers.	3.74	0.98	Agree
If I have leftover rice, I will process it into fried rice or other forms of food.	3.98	1.03	Agree
If I have fruit that is too ripe, I will process it into jam or other processed products.	2.87	1.28	Neutral

Constructs and Measuring Items	Score	St. dev	Category
I can adjust my cooking plan by taking into account the leftovers I have at home.	3.80	0.97	Agree
My kids love home food, so the food I cook is rarely left.	3.95	0.95	Agree
I don't buy food from outside if the food at home has not been consumed.	3.55	1.01	Agree
When I already cook, other family members eat at home	3.61	1.06	Agree
I can eat the same food consecutively in one day.	3.77	1.01	Agree
I understand that eating leftovers that are still decent doesn't have bad effects on health.	3.70	0.95	Agree
I rarely forget to keep leftovers in the refrigerator until they go stale.	2.86	1.32	Neutral
Average	**3.63**	**1.10**	**Agree (Very good)**

Table 4.3.5 Storage in Food Consumption Management in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
I label food purchase dates for food that doesn't have expiration date.	2.80	1.22	Neutral
I label the expiration date of the food I keep in the refrigerator.	2.82	1.20	Neutral
I arrange food by expiration date.	3.89	0.95	Agree
I check/know when the food is nearing the expiration date.	3.86	0.98	Agree
I eat food before its quality decreases (e.g., Before vegetables wilt, before tempeh turns yellow etc.).	3.87	0.93	Agree
I keep leftovers in the fridge to use again and they are rarely forgotten because I consume them later.	3.40	1.25	Agree
The food that I keep in the refrigerator is rarely forgotten even though the refrigerator is messy and full.	3.14	1.32	Agree
Average	**3.39**	**1.21**	**Agree (Very good)**

Table 4.3.6 Food Waste Disposal/Utilization of Food Consumption Management in SWU Case Study

Constructs and Measuring Items	Score	St. dev	Category
If I have excess food (bought/given) I will share it with neighbors/friends/relatives.	3.94	0.96	Agree
If I cook too much, I will share the food with neighbors/friends/relatives.	3.97	0.97	Agree
I will give leftovers to other people if they are intact and decent.	3.50	1.34	Agree
I will use the food leftovers to feed pets/livestock.	3.60	1.31	Agree
I accidentally cook more so that the rest can be given to the pets.	2.59	1.39	Neutral
I will process the leftovers into compost/liquid fertilizer.	2.81	1.41	Neutral
Average	**3.40**	**1.35**	**Agree (Very good)**

(2) Case Study of UGM Undergraduate Students' Households

Food consumption management in the case study of households of undergraduate UGM students are categorized into six variables namely planning, provision, preparation, serving/processing, storage and FW disposal/utilization. The respondents who answered the question items were the heads of households who are mainly in charge of food consumption at home. The results of the analysis for each category in food consumption management are presented as follows.

First, the food planning variable has an average score in the very good category. This is supported by eight indicators with agree responses and one indicator with strongly agree response. The households of UGM undergraduate students agreed on several indicators in food planning, namely making menu plans for a certain period, checking the stock in the refrigerator before making the shopping list, making a shopping list according to my needs, combining the number of items to be purchased to avoid overspending, make a shopping list and consistently follow the list when shopping, have adequate storage space so the food will lasts longer stored, shop according to the capacity of food storage, and plan to buy less food to reduce leftovers. In addition, they stated that they strongly agreed with the indicator that they would adjust the quantity of cooked food according to the number of family members present. The menu plans

and shopping list indicators have a rather high standard deviation, namely 1.08 and 1.04, respectively (Table 4.3.7).

Second, the food provision variable has an average score in the very good category. This is supported by one indicator with strongly agree response, five indicators with agree responses, and one indicator with neutral response. The household of UGM undergraduate students strongly agreed with the indicator that they will cook the ingredients available in the refrigerator before buying more. Furthermore, they agreed with five indicators, namely buy groceries/cooked food at a mobile vegetable vendor/food truck, shop, traditional market, mini market, and supermarket. In addition, they give response classified as neutral for the indicator of they buy groceries/cooked food online (Table 4.3.8).

Third, the food preparation variable has an average score in the good category, with each of the two indicators obtaining agree and neutral responses. The households of UGM undergraduate students agreed with the indicator that they usually use existing ingredients in the food preparation process. They also agreed that they used to cook for the amount of family needs. Meanwhile, they respond neutrally on two indicators, namely provide enough food that they need when there are guests, and not throw away fruits or vegetables with holes or not smooth (Table 4.3.9).

Fourth, the food serving/processing variable has an average score falling into the very good category. The households of UGM undergraduate students strongly agreed with the indicator that they will process the leftover rice into fried rice or other forms of food. They agree with nine indicators, namely: 1) If there are leftovers, our family usually eats them either in the same form or reheated, 2) before re-consumed, the leftover food will be processed into new food by adding other ingredients, 3) I feel comfortable when processing leftovers, 4) I feel comfortable when I eat decent leftovers, 5) I can adjust my cooking plan by taking into account the leftovers I have at home, 6) My kids love home food so the food I cook is rarely left, 7) I don't buy food from outside if the food at home has not been consumed, 8) I can eat the same food consecutively in one day, and 9) I understand that eating leftovers that are still decent doesn't have bad effects on health. Meanwhile, they responded neutral in three indicators, namely: 1) If I have fruit that is too ripe, I will process it into jam or other processing, 2) When I already cook, other family members eat at home, and 3) I rarely forget to keep leftovers in the refrigerator until they go stale. The last three indicators mentioned have rather high standard deviations which vary between 1.08 and 1.20 (Table 4.3.10).

Fifth, the food storage variable records an average score which belongs to the good category. Two indicators get agree responses, namely statement items stating: 1) I check/know

when the food is nearing the expiration date, and 2) I eat food before its quality decreases (e.g. Before vegetables wilt, before tempeh turns yellow etc.). Meanwhile, the other five indicators receive neutral responses, namely: 1) I label food purchase dates for food that doesn't have an expiration date, 2) I label the expiration date of the food I keep in the refrigerator, 3) I arrange food by expiration date, 4) I keep leftovers in the fridge to use again and they are rarely forgotten because we consume them later, and 5) The food that I keep in the refrigerator is rarely forgotten even though the refrigerator is messy and full (Table 4.3.11).

Sixth, the FW disposal/utilization variable has an average score in the very good category. Two indicators get strongly agree responses, namely the items regarding 1) If I have excess food (buy/given) I will share it with neighbors/friends/relatives, and 2) If I cook too much, I will share the food with neighbors/friends/relatives. Next, three indicators receive agree responses, namely: 1) I will give leftovers to other people if they are intact and decent, 2) I will use the food leftovers to feed pets/livestock, 3) I accidentally cook more so that the rest can be given to the pets. Additionally, one indicator has neutral response namely: I will process the leftovers into compost/liquid fertilizer (Table 4.3.11).

The above results from the survey are similar to the information from the participants in the FGD activities. Regarding food planning, the participants have planned well, especially in adjusting the amount purchased with the capacity of the food storage space and provision the amount of food cooked based on the number of family members. The results of this study support the previous studies which state the importance of food planning in reducing household food waste (Principato et al., 2020; Schanes et al., 2018). Furthermore, a study by Babbitt et al., (2021) also confirmed a positive correlation between food planning activities and a decrease in household FW. The participants also have good shopping planning in the households by making shopping lists and consistently following the list when shopping. Making shopping lists is essential for households to avoid excessive shopping behavior and have an impact on decrease in FW. Ponis et al., (2017) state that shopping behavior outside the shopping list would increase the number of food purchases so households tend to throw away more food.

As regards food provision, the participants stated that they purchased from various places such as food trucks, shops, traditional markets, mini markets, supermarkets, and online. The highest proportion of providing food is through traditional markets because the prices are lower compared to other places, while the lowest supply is online. A study by Minten and Reardon (2008) found that the difference in the quality and price of goods was higher in supermarkets than in traditional markets, which affects household shopping preference. Furthermore, Soma, (2020) also found a significant relationship between the amount of

household FW and the choice of the retail store, where the option to shop at the supermarket could increase FW. In Indonesia, there are still a few parents' households that make purchases online, in addition to higher product prices, they also need to be technologically literate. An increase in habits like food preservation is substantially connected with less household FW. For instance, a significant correlation was found between decreased household FW and an increase in practices like food preservation (Babbit et al., 2021). FW generated from fruits, vegetables, dairy, and frozen goods increases as a result of over-provision, so the most effective way to start reducing waste in the food categories examined is through food storage measures (Ananda et al., 2022).

In terms of food preparation, participants state that they usually prepare excess food when there are guests because this is indeed a social norm in Indonesia. Apart from that, they throw away fruits and vegetables that have holes and do not look good. The conditions related to healthy fruits and vegetables with holes as an indication of low use of pesticides are still low. Aktas et al*.,* (2018) state that food surplus is higher when social interactions are reflected in hospitality and communal dining (hospitality, aversion to taking the risk of running out of food to serve, and cultural customs about food service) and contribute to FW. Based on the Stangherling et al.'s (2020) research, social norms may have an impact on FW reduction, therefore they must be supported systemically by education and other initiatives.

In terms of food serving/processing, the participants show high interest and motivation to reduce FW by processing leftovers, namely by reheating leftovers, processing leftovers by adding other ingredients, for example, making fried rice, or processing fruit into jam and other processed forms. The high interest of households in processing FW is also evident from the feeling of comfort when they process and consume leftover food that is still decent. The participants stated that they could adjust cooking plans by considering the leftover food at home and the habit of not buying food from outside if the food had not yet been consumed. Food processing activities, especially in utilizing leftover food, are essential in reducing FW. Previous studies also state that households that regularly consume or process leftover food will produce less FW (Babbitt et al., 2021; Schanes et al., 2018).

In relation with storage activities, the participants show the efforts to store food properly, for example, by labeling the date of purchase on food that does not have an expiration date, labeling the expiration date on food stored in the refrigerator, and arranging the location of food based on the expiration date. However, households still need substantial efforts and motivation to carry out food labeling activities to reduce FW. The importance of food labeling in reducing food waste was also described in the previous studies by Milne (2012) and Schanes

et al.(2018). Food labels related to information on use date and expiration date are important because they are the primary consideration in food storage (Gojard et al., 2021). Another thing that still needs to be improved by households because it can potentially increase FW is remembering the leftover food that has been stored in the refrigerator and trying to keep food in an orderly condition. Regularity in food storage aims to make it easier to see and find food and prevent food from being forgotten because it is hidden in the back of the fridge/storage cupboard. This is in line with the previous research, which states the importance of food storage to reduce FW (Ananda et al., 2022; Farr-Wharton et al., 2014; Schanes et al., 2018). Furthermore, Waitt and Phillips (2016) explain that food storage efforts are essential because they include three activities, namely placing food, rotating food in order, and assessing food suitability.

Finally, the participants show the efforts to reduce FW by sharing food with neighbors/friends/relatives when there is excess food or when cooking in large quantity. However, other findings show that households sometimes feel reluctant to give leftover food to others even though the food is still fit for consumption. Other efforts that households make in disposing/utilizing FW are by giving leftover food to pets/livestock and processing it into compost/liquid fertilizer. This is in line with the previous studies which state that disposing /utilizing food scraps by sorting and composting activities could reduce the amount of FW (Secondi et al., 2015). Furthermore, Nguyen et al., (2022) also mention the three main activities at the stage of disposing/utilizing FW, namely by giving it to livestock, processing it as household compost, and sorting FW in organic waste bins.

In sum, the performance of the six stages in Food consumption management (FCM), which includes the stages of planning, food provision, food preparation, food serving/processing, food storage, and FW disposal fall into the very good category, except for the stages of food preparation and storage which are still included in the good category. The undergraduate students' parents' households' planning stage is included in the very good category, especially in the aspects of adjusting the number of purchases to the capacity of the food storage space, providing the amount of food cooked based on the number of family members, and making a shopping list and consistently following the list while shopping. The undergraduate student's parents' households also belong to the very good category in providing food. The majority of households buy food from traditional markets. Apart from that, they also buy food from food trucks, shops, mini markets, and supermarkets and buy online. The process of preparing food for the undergraduate students' parents' households falls into the good category. They usually prioritize the use of ingredients that are already there, preparing food

according to the number of household members. However, due to cultural reasons, it is common for households to prepare excess food when guests are present. In addition, households actually throw away fruits and vegetables with holes because they are considered to be ugly.

The serving/processing stage in food consumption management is included in the very good category. An interesting finding is that there is high interest and motivation from undergraduate students' parents' households to reduce FW, namely by processing leftovers, for example by reheating leftovers, making fried rice, or processing fruit into jam. On the other hand, the storage stage is included in the good category. Several question items have a very good score category, namely the efforts of the household to check food expiration dates, to consume the food before the expiration date, and to do product labeling. Lastly, the FW disposal/utilization stage belongs to the very good category. Households have tried to reduce FW by sharing food with neighbors/friends/relatives when there is excess food or when cooking in large quantity. Nevertheless, some households feel reluctant to give leftover food to others even though the food is still fit for consumption.

Table 4.3.7 Food Consumption Management Planning in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
I make menu plans for a certain period (e.g., daily plan, weekly plan).	3.21	1.08	Agree
I will check the stock in the refrigerator before making the shopping list.	3.90	0.89	Agree
I will make a shopping list according to my needs.	3.95	0.85	Agree
I combine the number of items to be purchased to avoid overspending.	3.76	0.96	Agree
I make a shopping list and consistently follow the list when shopping.	3.40	1.04	Agree
I have adequate (decent) storage space so that the food I store lasts longer.	3.96	0.79	Agree
I will shop according to the capacity of my food storage (e.g., refrigerator or other storage space).	4.07	0.69	Agree
To reduce leftovers, I plan to buy less food.	3.92	0.73	Agree
I will adjust the quantity of cooked food according to the number of family members present.	4.32	0.58	Strongly agree

Constructs and Measuring Items	Score	St. dev	Category
Average	**3.83**	**0.85**	**Agree (Very good)**

Table 4.3.8 Food Consumption Management Provision in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
I will cook the ingredients available in the refrigerator before buying more.	4.16	0.67	Strongly agree
I buy groceries/cooked food at a mobile vegetable vendor/food truck.	3.51	1.14	Agree
I buy groceries/cooked food at the shop.	3.70	0.91	Agree
I buy groceries/cooked food at the traditional market.	4.03	0.85	Agree
I buy groceries/cooked food at the mini market.	3.19	1.06	Agree
I buy groceries/cooked food at the supermarket.	3.17	1.13	Agree
I buy groceries/cooked food online.	2.21	1.08	Neutral
Average	**3.43**	**0.98**	**Agree (Very good)**

Table 4.3.9 Food Consumption Management Preparation in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
In the food preparation process, I usually use existing ingredients.	3.93	0.74	Agree
I am used to cooking for the amount my family needs.	3.35	1.09	Agree
If there are guests, I will provide enough food that they need. (I have never followed the principle of "it's better to have leftovers than serving less food").	2.16	0.87	Neutral
I don't throw away fruits or vegetables with holes or not smooth.	2.54	1.00	Neutral
Average	**2.99**	**0.92**	**Neutral (Good)**

Table 4.3.10 Food Consumption Management Serving/Processing in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
If there are leftovers, our family usually eats them either in the same form or reheated.	4.00	0.69	Agree
Before re-consumed, the leftover food will be processed into new food by adding other ingredients.	3.50	0.90	Agree
I feel comfortable when processing leftovers.	3.48	0.83	Agree
I feel comfortable when I eat decent leftovers.	3.85	0.70	Agree
If I have leftover rice, I will process it into fried rice or other forms of food.	4.23	0.66	Strongly agree
If I have fruit that is too ripe, I will process it into jam or other processed products.	3.00	1.11	Neutral
I can adjust my cooking plan by taking into account the leftovers I have at home.	3.96	0.68	Agree
My kids love home food so the food I cook is rarely left.	3.87	0.81	Agree
I don't buy food from outside if the food at home has not been consumed.	3.64	0.97	Agree
When I already cook, other family members eat at home	2.61	1.08	Neutral
I can eat the same food consecutively in one day.	3.82	0.96	Agree
I understand that eating leftovers that are still decent doesn't have bad effects on health.	3.93	0.75	Agree
I rarely forget to keep leftovers in the refrigerator until they go stale.	2.86	1.20	Neutral
Average	**3.60**	**0.87**	**Agree (Very good)**

Table 4.3.11 Storage in Food Consumption Management in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
I label food purchase dates for food that doesn't have expiration date.	2.32	1.01	Neutral
I label the expiration date of the food I keep in the refrigerator.	2.34	0.99	Neutral
I arrange food by expiration date.	2.46	1.05	Neutral

Constructs and Measuring Items	Score	St. dev	Category
I check/know when the food is nearing the expiration date.	3.61	0.99	Agree
I eat food before its quality decreases (e.g. Before vegetables wilt, before tempeh turns yellow etc.).	3.77	0.88	Agree
I keep leftovers in the fridge to use again and they are rarely forgotten because I consume them later.	2.72	1.12	Neutral
The food that I keep in the refrigerator is rarely forgotten even though the refrigerator is messy and full.	3.03	1.11	Neutral
Average	**2.90**	**1.02**	**Neutral (Good)**

Table 4.3.12 Food Waste Disposal//Utilization of Food Consumption Management in UGM Case Study

Constructs and Measuring Items	Score	St. dev	Category
If I have excess food (buy/given) I will share it with neighbors/friends/relatives.	4.21	0.71	Strongly agree
If I cook too much, I will share the food with neighbors/friends/relatives.	4.17	0.76	Strongly agree
I will give leftovers to other people if they are intact and decent.	3.32	1.16	Agree
I will use the food leftovers to feed pets/livestock.	3.86	1.09	Agree
I accidentally cook more so that the rest can be given to the pets.	3.69	1.04	Agree
I will process the leftovers into compost/liquid fertilizer.	2.69	1.15	Neutral
Average	**3.65**	**0.98**	**Agree (Very good)**

(3) Statistics Comparing Two Groups: SWU and UGM

Based on the results of six variables for food consumption management in the case study of households of SWU and UGM undergraduate students as previously elaborated, it can be concluded by comparing the two groups as follows: There are four variables between the case of SWU and UGM that are in the same very good category, namely Planning, Provision, Serving/Processing, and Food Waste Disposal/Utilization. The variable of Preparing between the case of SWU and that of UGM falls into in the same category which is good category. In

addition, the variable of Storage in the case of UGM is in the good category, while this variable in the case of SWU is in the very good category. Within the variable, the top three indicators showing high average scores are rather the same. On the other hand, according to the results of statistics comparing the two groups, the *z*-statistics with *p*-value reflect the average scores of three variables (Planning, Provision, and Serving/Processing) between the case of UGM and that of SWU are not statistically different with a statistical significance (*p*-value < 0.05). On the other hand, the average scores of the variable of Preparing and Food Waste Disposal/Utilization in the case of UGM are greater than those of SWU with a statistical significance (*p*-value < 0.05). It can be noticed that the average score of only one variable, which is the Storage variable, of the SWU case is greater than that of UGM case. The details of indicators in each variable are as follows.

With respect to the results of statistics comparing two groups of indicators in the variable of Planning, the average values of three indicators in the case of UGM are greater than those of SWU with a statistical significance (*p*-value < 0.05 and 0.01), namely Checking the stock in the refrigerator before making the shopping list, Making a shopping list according to the needs, and Shopping according to the capacity of the food storage. On the other hand, the average values of six indicators in the case of UGM are not statistically different from those of SWU at 0.05 significance level, namely Making menu plans for a certain period (e.g., daily plan, weekly plan), Combining the number of items to be purchased to avoid overspending, Making a shopping list and consistently follow the list when shopping, Having adequate (decent) storage space so that the food stored lasts longer, To reduce leftovers, planning to buy less food, and Adjusting the quantity of cooked food according to the number of family members present. (Table 4.3.13 a.). Apart from this, regarding the variable of Provision, the average scores of five indicators in the case of SWU are greater than those of UGM with a significance level of 0.01, including Cooking the ingredients available in the refrigerator before buying more, Buy groceries/cooked food at the traditional market, the mini market, the supermarket, and online. Meanwhile, the average scores of two indicators in the case of SWU are greater than those of UGM with a statistical significance (*p*-value < 0.05 and 0.01), those are Buying groceries/cooked food at a mobile vegetable vendor/food truck and at shop (Table 4.3.13 b.).

Next, based on the results of statistics comparing two groups in the indicators of the variable of Preparation, the average scores of the items “If there are guests, I will provide enough food that they needed” and “I don’t throw away fruit or vegetables with holes or not

smooth" in the case of SWU case are greater than those of UGM case with a statistical significance (p-value < 0.01). On the other hand, the average score of the items "In the food preparation process, I usually use existing ingredients" and "I am used to cooking for the amount my family needs" in the case of the SWU case is lower than that of UGM case with a statistical significance (p-value < 0.10 and 0.01). (Table 4.3.13 c.).

The results of statistics comparing two groups of indicators in the variable of Serving/Processing, the average scores of four indicators of the SWU case are greater than those of the UGM case with a statistical significance (p-value < 0.05 and 0.01), namely (i) If there are leftovers, our family usually eats them either in the same form or reheated, (ii) Before re-consumed, the leftover food will be processed into new food by adding other ingredients, (iii) I feel comfortable when processing leftovers, and (iv) When I already cook, my family members eat at home. On the other hand, the average scores of five indicators of the UGM case are greater than those of the SWU case with a statistical significance (p-value < 0.05 and 0.01), namely (i) I feel comfortable when I eat decent leftovers, (ii) If I have leftover rice, I will process it into fried rice or other forms of food, (iii) If I have fruit that is too ripe, I will process it into jam or other processed products. (iv) I can adjust my cooking plan by taking into account the leftovers I have at home, (v) I can eat the same food consecutively in one day, and (vi) I understand that eating leftovers that are still decent doesn't have bad effects on health. However, the indicators of "My kids love home food so the food I cook is rarely left" as well as "I don't buy food from outside if the food at home has not been consumed" in both cases of SWU and UGM are not statistically different with a statistical significance (p-value < 0.05). As is noticed, although the average score of an indicator of "I rarely forget to keep leftovers in the refrigerator until they go stale" in the case of SWU and UGM in the form of two decimal places cannot be seen clearly which one is greater, this indicator in the case of SWU and UGM is statistically different with a statistical significance (p-value < 0.05) (Table 4.3.13 d.).

In terms of the variable of Storage for food consumption management, the results of statistics comparing two groups of indicators indicate that the average scores of five indicators of the SWU case are greater than those of the UGM case with a statistical significance (p-value < 0.05 and 0.01), namely Labeling food purchase dates for foods that doesn't have an expiration date, Labeling the expiration date of the food I keep in the refrigerator, Arranging food by expiration date, Checking/knowing when the food is nearing the expiration date, and The food that I keep in the refrigerator is rarely forgotten even though the refrigerator is messy and full. Meanwhile, the average scores of two indicators are not statistically different between SWU

and UGM with a significance level of 0.05, namely Eating food before its quality decreases (e.g., Before vegetables wilt, before tempeh turns yellow, etc.), and Keeping leftovers in the fridge to use again and they are rarely forgotten because I consume them later (Table 4.3.13 e.).

Lastly, the results of statistics comparing two groups of indicators show that the average scores of indicators “If I have excess food (buy/given) I will share it with neighbors/friends/relatives”, “I accidentally cook more so that the rest can be given to the pets”, “If I cook too much, I will share the food with neighbors/friends/relatives”, and “I will use the food leftovers to feed pets/livestock” in the case of the UGM case are greater than those of the SWU case with a statistical significance (p-value < 0.10 and 0.01). Nevertheless, the average scores of the indicators “I will give leftovers to other people if they are intact and decent”, and “I will process the leftovers into compost/liquid fertilizer” in the case of UGM case are less than those of the SWU case with a statistical significance (p-value < 0.01) (Table 4.3.13 f.).

From the above statements, the statistical results could infer that Preparing and Food Waste Disposal/Utilization for food consumption management in the case study of households of UGM undergraduate students seems to be better than that of households of SWU undergraduate students. This may be because around 54% of the respondents of UGM households live in rural areas. With respect to cultural cooking preparation and food waste utilization, they can re-cook the leftover food ingredients and if food is still left then it is given to livestock they raise, or to neighbors. On the other hand, the statistical results could imply that Storage for food consumption management in the case study of households of SWU undergraduate students is better than that of the households of UGM undergraduate students. This may be because around 64% of the respondents of SWU households live in urban areas. Moreover, around 75% of the respondents strongly agree/agree that they buy groceries/food at the supermarket. Most groceries/food present the expiration date on their package so it is easy for food arrangement by expiration date. These are confirmed by the information from the in-depth interviews where most participants said that they checked/knoew when the food was nearing the expiration date.

Table 4.3.13 Results of Statistical Comparison between Two Groups (SWU and UGM)

a. Food Consumption Management Planning

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I make menu plans for a certain period (e.g., daily plan, weekly plan).	3.39	3.21	0.19 (0.11)
I will check the stock in the refrigerator before making the shopping list.	3.77	3.90	1.51 (0.02)**
I will make a shopping list according to my needs.	3.70	3.95	1.97 (0.00)***
I combine the number of items to be purchased to avoid overspending.	3.78	3.76	0.48 (0.98)
I make a shopping list and consistently follow the list when shopping.	3.54	3.40	1.07 (0.20)
I have adequate (decent) storage space so that the food I store lasts longer.	3.87	3.96	1.01 (0.26)
I will shop according to the capacity of my food storage (e.g., refrigerator or other storage space).	3.76	4.07	2.47 (0.00)***
To reduce leftovers, I plan to buy less food.	3.90	3.92	0.57 (0.89)
I will adjust the quantity of cooked food according to the number of family members present.	4.27	4.32	0.79 (0.56)
Average	**3.77**	**3.83**	**0.76 (0.59)**

b. Food Consumption Management Provision

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I will cook the ingredients available in the refrigerator before buying more.	4.25	4.16	1.88 (0.00)***
I buy groceries/cooked food at a mobile vegetable vendor/food truck.	2.92	3.51	3.09 (0.00)***
I buy groceries/cooked food at the shop.	3.22	3.70	1.62 (0.01)**
I buy groceries/cooked food at the traditional market.	4.22	4.03	1.72 (0.00)***
I buy groceries/cooked food at the mini market.	3.43	3.19	3.93 (0.00)***

Constructs and Measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I buy groceries/cooked food at the supermarket.	3.94	3.17	1.77 (0.00)***
I buy groceries/cooked food online.	2.26	2.21	2.04 (0.00)***
Average	**3.46**	**3.43**	**0.83 (0.56)**

c. Food Consumption Management Preparation

Constructs and measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
In the food preparation process, I usually use existing ingredients.	2.27	3.93	2.04 (0.00)***
I am used to cooking for the amount my family needs.	2.56	3.35	1.29 (0.07)*
If there are guests, I will provide enough food that they need. (I have never followed the principle of "it's better to have leftovers than serving less food").	3.43	2.16	2.87 (0.00)***
I don't throw away fruit or vegetables with holes or not smooth.	2.93	2.54	2.90 (0.00)***
Average	**2.79**	**2.99**	**3.26 (0.00)***

d. Food Consumption Management Serving/Processing

Constructs and measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
If there are leftovers, our family usually eats them either in the same form or reheated.	4.15	4.00	1.94 (0.00)***
Before re-consumed, the leftover food will be processed into new food by adding other ingredients.	3.67	3.50	1.82 (0.00)***
I feel comfortable when processing leftovers.	3.68	3.48	2.04 (0.00)***
I feel comfortable when I eat decent leftovers.	3.74	3.85	1.48 (0.02)**
If I have leftover rice, I will process it into fried rice or other forms of food.	3.98	4.23	1.68 (0.00)***
If I have fruit that is too ripe, I will process it into jam or other processed products.	2.87	3.00	1.75 (0.00)***

Constructs and measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I can adjust my cooking plan by taking into account the leftovers I have at home.	3.80	3.96	2.00 (0.00)***
My kids love home food so the food I cook is rarely left.	3.95	3.87	1.12 (0.16)NS
I don't buy food from outside if the food at home has not been consumed.	3.55	3.64	0.88 (0.42)NS
When I already cook, my family members eat at home	3.61	2.61	1.57 (0.01)**
I can eat the same food consecutively in one day.	3.77	3.82	0.98 (0.01)**
I understand that eating leftovers that are still decent doesn't have bad effects on health.	3.70	3.93	1.83 (0.00)***
I rarely forget to keep leftovers in the refrigerator until they go stale.	2.86	2.86	1.54 (0.02)**
Average	**3.63**	**3.60**	**0.93 (0.35)**

e. Storage in Food Consumption Management

Constructs and measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
I label food purchase dates for food that doesn't have expiration date.	2.80	2.32	3.45 (0.00)***
I label the expiration date of the food I keep in the refrigerator.	2.82	2.34	3.48 (0.00)***
I arrange food by expiration date.	3.89	2.46	7.73 (0.00)***
I check/know when the food is nearing the expiration date.	3.86	3.61	1.83 (0.00)***
I eat food before its quality decreases (e.g. Before vegetables wilt, before tempeh turns yellow etc.).	3.87	3.77	1.08 (0.19)
I keep leftovers in the fridge to use again and they are rarely forgotten because I consume them later.	3.40	2.72	1.18 (0.12)
The food that I keep in the refrigerator is rarely forgotten even though the refrigerator is messy and full.	3.14	3.03	1.47 (0.03)**
Average	**3.39**	**2.90**	**4.16 (0.00)***

f. Food Waste Disposal/Utilization of Food Consumption Management

Constructs and measuring Items	$\bar{X}_{SWU}$	$\bar{X}_{UGM}$	Z statistics
If I have excess food (buy/given) I will share it with neighbors/friends/relatives.	3.94	4.21	1.83 (0.00)***
If I cook too much, I will share the food with neighbors/friends/relatives.	3.97	4.17	1.26 (0.08)*
I will give leftovers to other people if they are intact and decent.	3.50	3.32	4.34 (0.00)***
I will use the food leftovers to feed pets/livestock.	3.60	3.86	1.27 (0.08)*
I accidentally cook more so that the rest can be given to the pets.	2.59	3.69	2.27 (0.00)***
I will process the leftovers into compost/liquid fertilizer.	2.81	2.69	1.69 (0.00)***
Average	**3.40**	**3.65**	**3.33 (0.00)***

Note: The figure in parenthesis means *p*-value of z-statistics. The asterisk *, **, and *** denoted statistically significant results at 0.10 level (the *p*-value < 0.10), 0.05 ((the *p*-value < 0.05) and 0.01 level (the *p*-value < 0.01), respectively.

Chapter 5

Conclusion and Policy Recommendations

5.1 Conclusion

Three objectives of the research are to analyze the FW awareness of undergraduate students, to estimate the amount of household FW and its determinants, as well as to analyze food consumption management. With respect to research methodology, the population was focused on SWU (Thailand) and UGM (Indonesia). The main results are concluded as follows: according to the study results of food waste awareness in Table 5.1, there are three variables between the case of SWU and UGM that are in the same good category, namely health awareness, environmental awareness, and FW reduction potential. Meanwhile, there are three variables in the case of SWU and UGM that are in different categories. The perception of FW reduction consequences and its practical benefits, economic awareness, social, cultural awareness and FW guilt in the case of UGM are in excellent category, while those variables in the case of SWU are in very good category.

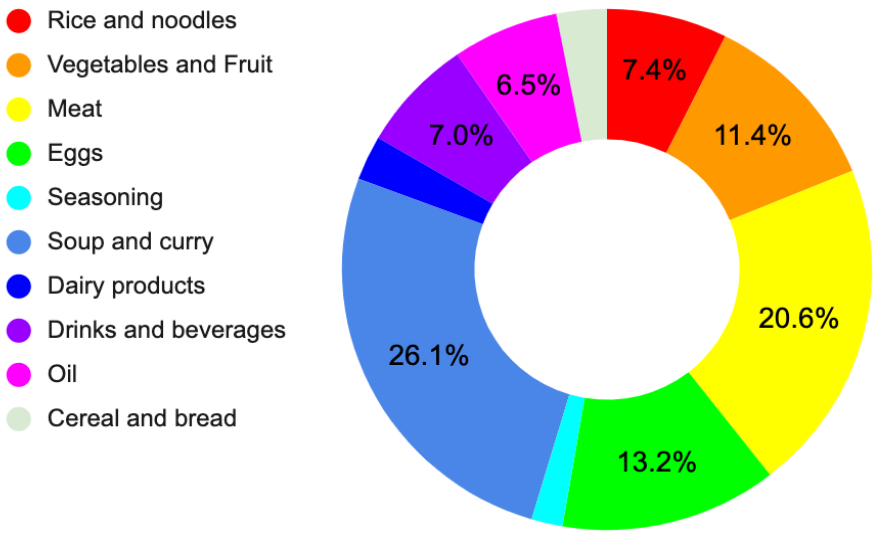
Table 5.1 Summary of Food Waste Awareness of Undergraduate Students in SWU and UGM

Variable	SWU (Thailand)		UGM (Indonesia)		Z Statistics
	Score	Category	Score	Category	
Perception of Food Waste Reduction Consequences and Its Practical Benefits	4.05	Excellent	4.32	Excellent	3.95 (0.00)***
Health Awareness	3.26	Very good	3.64	Very good	4.89 (0.00)***
Economic Awareness	3.94	Very good	4.19	Excellence	2.27 (0.00)***
Social, Cultural Awareness, and Food Waste Guilt	3.58	Very good	4.05	Excellence	6.62 (0.00)***
Environmental Awareness	3.84	Very good	3.92	Very good	1.36 (0.05)*

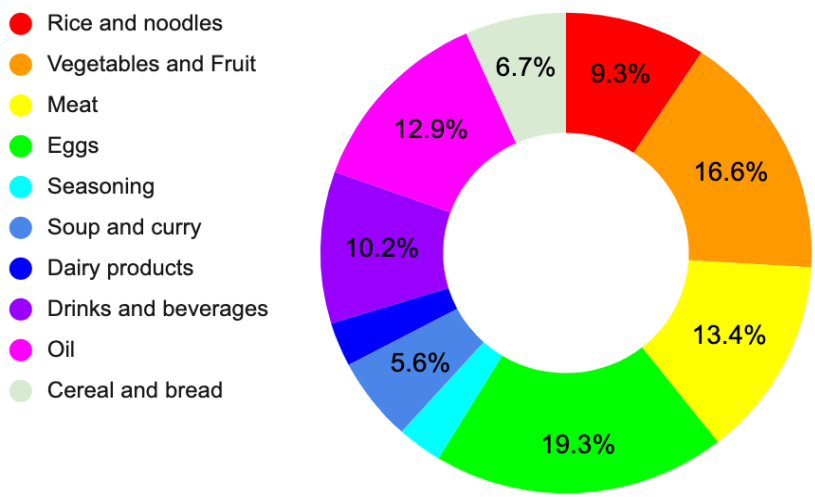
Variable	SWU (Thailand)		UGM (Indonesia)		Z Statistics
	Score	Category	Score	Category	
Food Waste Reduction Potential	3.28	Very good	3.59	Very good	3.12 (0.00)***

Note: The figure in parenthesis means *p*-value of Z Statistics. The asterisk *, and *** denoted statistically significant results (the *p*-value < 0.10), and 0.01 level (the *p*-value < 0.01), respectively.

In addition, based on the results of statistics comparing the two groups, the *z*-statistics with *p*-value reflects that the average values of all variables in the case of UGM are greater than those of SWU with a statistical significance (*p*-value < 0.10 and 0.01) respectively. In conclusion, the food waste awareness of UGM undergraduate students seems to be better than that of SWU undergraduate students. This may be because UGM undergraduate students have a better perception of understanding food waste. This perception is closely related to the aspects of household knowledge and habits in treating food waste which are repeated, so it becomes the culture of Indonesian society. The sources of knowledge and habits regarding food waste for students derive from family, community environment, education, and media exposure.



a. The case of SWU household (Thailand)

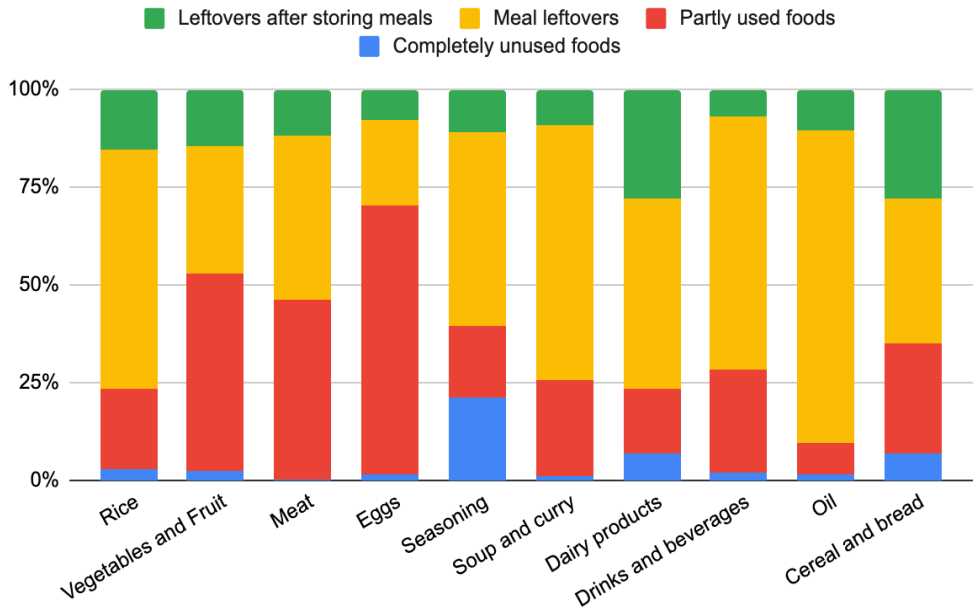


b. The case of UGM household (Indonesia)

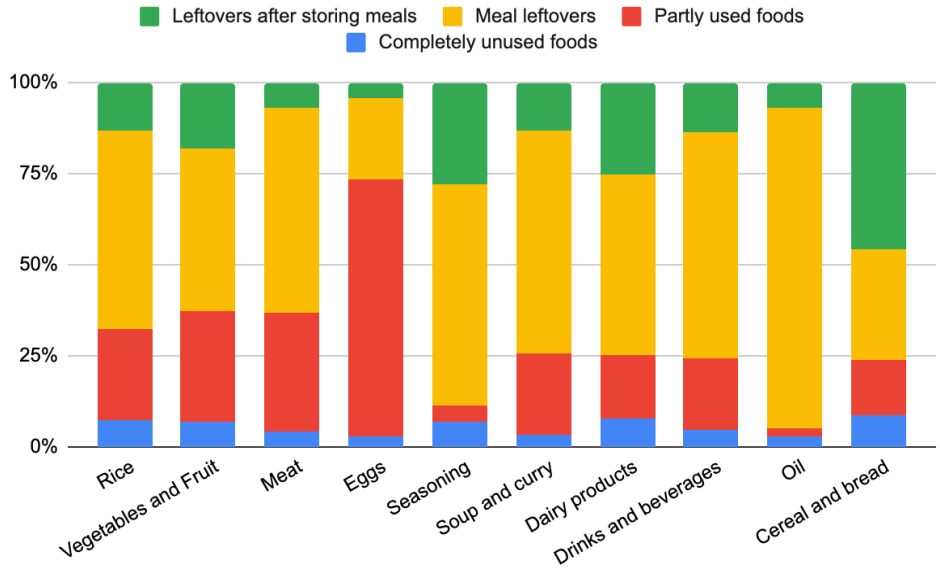
Figure 5.1 Percentage of Food Items from Total Amount of Food Waste in the Cases of SWU and UGM Students' Households

The main study results of a 24-hour recall survey of household food waste in the case of SWU and UGM are depicted in Figures 5.1 and 5.2. In 2023 the estimated amount of FW in the case of SWU and UGM is about 42.78 and 24.50 kg/capita respectively. Moreover, both cases reveal that the main FW items are originated from Meat, Eggs, Vegetables and Fruit, as well as Rice and noodles (Figure 5.1). In addition, both cases find that most of the household FW arises from leftovers (Figure 5.2). The economic losses of FW in the total household of SWU and UGM undergraduate students are supposed to be asserted because in 2023 it reaches about 12.57 million THB (370,799.35 USD) and 5,474.65 million IDR per (527,315.95) respectively. Theoretically, these economic values can be reallocated into the public budget that the Thai and Indonesian governments can spend on productive economic activities. In addition, the demographic and economic variables, as well as habit variables reveal that the reasons why food gets wasted in the household are the essential factor affecting the amount of FW, and not the results of the estimation of Tobit Model. The main results are illustrated in Table 5.2. The estimated Tobit model in both cases can be concluded that the independent variables of age of the head of the household, food expenditure per month, number of family members, and area where the household resides have impacts on the amount of FW with a statistical significance (p-value < 0.10, 0.05, and 0.001). Regarding the habit and attitude variables, surprisingly, the independent variable of moral attitude has an impact on the amount

of FW with a statistical significance (p-value < 0.05 and 0.001). Although both cases are in ASEAN countries, the effects of those independent variables on the types of FW items are different due to different structures of the both countries' economy and society, different styles of traditional food, and different eating cultures.



a. The case of SWU household (Thailand)



b. The case of UGM household (Indonesia)

Figure 5.2 Categories of Food Waste in the Cases of SWU and UGM Students' Households (% of respondents)

Table 5.2 Summary of Result Estimation in Tobit Model

Factors	Food Waste Disposed by Households			
	SWU (Thailand)	**Sign**	**UGM (Indonesia)**	**Sign**
Age of the head of the household	Rice and noodles including their derivative products	(-)*	Meat including their derivative products	(-)*
Household income per month	Vegetables and Fruit including their derivative products	(+)**	Non-statistically significant result	
	Oil	(+)***		
Food expenditure per month	Seasoning	(+)**	Seasoning	(+)***
	Drinks and beverages	(+)*		
Number of family members	Dairy products	(+)**	Rice and noodles including their derivative products	(+)**
			Oil	(+)**
Number of children	Dairy products	(+)**	Non-statistically significant result	
Number of elderly people	Seasoning	(+)*	Non-statistically significant result	
Last education of the head of household	Eggs including eggshell	(-)**	Soup and curry	(+)***
	Oil	(-)***		
Gender of the respondent (1 = Female and 0 = Male)	Drinks and beverages	(-)*	Non-statistically significant result	
Area where the household resides (1 = Urban and 0 = Rural)	Vegetables and Fruit including their derivative products	(-)*	Rice and noodles including their derivative products	(-)**
			Soup and curry	(-)**
			Oil	(-)**
Marital status (1 = Single and 0 = Married / Widow)	Eggs including eggshell	(-)*	Non-statistically significant result	

Factors	Food Waste Disposed by Households			
	SWU (Thailand)	Sign	UGM (Indonesia)	Sign
Personal habits (as a z-score)	Ambiguous result		Ambiguous result	
Shopping habits (as a z-score)	Ambiguous result		Ambiguous result	
Product characteristics (as a z-score)	Ambiguous result		Ambiguous result	
Moral attitude (as a z-score)	Seasoning	(-)***	Rice and noodles including their derivative products	(-)**
	Drinks and beverages	(-)**	Soup and curry	(-)**

Note: The figure in parenthesis means *p*-value of Z Statistics. The asterisk *, **, and *** denoted statistically significant results at 0.10 level (the *p*-value < 0.10), 0.05 level (the *p*-value < 0.05), and, 0.01 level (the *p*-value < 0.01), respectively.

Table 5.3 Summary of Food Consumption Management in the Households of Undergraduate Students in SWU and UGM

Variable	SWU (Thailand)		UGM (Indonesia)		Z statistics
	Score	Category	Score	Category	
Planning	3.77	Very Good	3.83	Very Good	(0.59)
Providing	3.46	Very Good	3.43	Very Good	(0.56)
Preparation	2.79	Good	2.99	Good	(0.00)***
Serving/Processing	3.63	Very Good	3.60	Very Good	(0.35)
Storage	3.39	Very Good	2.90	Good	(0.00)***
Food Waste Disposal/Usage	3.40	Very Good	3.65	Very Good	(0.00)***

Note: The figure in parenthesis means *p*-value of Z statistics. The asterisk *** denoted statistically significant results 0.01 level (the *p*-value < 0.01).

The results of six variables of food consumption management in the case study of the households of SWU and UGM undergraduate students are presented in Table 5.3. The main results can be concluded by comparing the two groups as follows: There are four variables between the case of SWU and UGM that are in the same category namely very good, those are Planning, Providing, Serving/Processing, and Food Waste Disposal/Usage. The variable of

Preparing between the case of SWU and UGM is in the same category, namely good. In addition, the variable of Storage in the case of UGM is in the good category, while this variable in the case of SWU is in the very good category. Within the variable, the top three indicators showing high average scores are rather the same. On the other hand, according to the results of statistics comparing the two groups, the *z*-statistics with *p*-value reflect the average scores of three variables (Planning, Providing, and Serving/Processing) between the case of UGM and SWU which are not statistically different with a statistical significance (p-value < 0.05). On the other hand, the average scores of the variable of Preparing and Food Waste Disposal/Utilization in the case of UGM are greater than those of SWU with a statistical significance (p-value < 0.05). This may be because around 54% of the respondents from UGM households live in rural areas, with respect to cultural cooking preparation and food waste utilization. They can cook with the leftover ingredients, and if there are still leftovers, they will be given to their raised livestock, or to neighbors. The average score of Storage variable of SWU is greater than that of UGM. This may be because around 64% of the respondents from SWU households live in urban areas. Moreover, around 75% of the respondents strongly agree/agree that they buy groceries/food at the supermarket. Most groceries/foods present the expiration date on their packages thus easily for food arrangement by expiration date.

5.2 Policy Recommendations

(1) Food Waste Awareness of Young People

(i) Food waste awareness of UGM undergraduate students seems to be better than that of SWU undergraduate students. Therefore, SWU policymakers can learn from the experience of UGM in which UGM facilitates the waste management programs by establishing the Recycling Innovation House facilities at the AgroTechnology Innovation Center. This facility is useful for learning the knowledge and information about waste management.

(ii) Although FW awareness in both cases is categorized into very good and excellent categories, the average scores of the variable of FW Reduction Potential in both cases are rather low compared to all variables. It can be the policy implication for young people in ASEAN countries. The awareness of young generation should be built to understand well the negative impacts of FW particularly on the issue of FW reduction potential and improvement of food consumption behavior, so they will become more responsible food consumers and contribute significantly to reducing FW at the household level. Moreover, based on the information from

FGD/in-depth interviews, regarding the campaign for FW reduction, making a video clip on TikTok and a Twitter Thread can be a good option due to its popularity among the new generation.

(iii) The average scores of all variables of FW awareness can be implied that young people at the university level have a very good perception. To strengthen this, the Ministry of Education should collaborate with the local governments to early introduce the knowledge of FW, the causes of FW, and tips to reduce it to the students of kindergarten, elementary, middle, and high school.

(2) Amount and Value of Household Food Waste and its Determinants

(i) In 2023 the estimated amount of FW from the households of SWU and UGM undergraduates is about 42.78 and 24.50 kg/capita respectively. Therefore, the dissemination of knowledge of FW, its impact, and tips to reduce it including the empowerment of housewives through campaigns, training, and promotion about FW should be conducted to save their household food consumption spending. Apart from this, in terms of economic perspective, the total values of SWU and UGM undergraduates' FW are around 370,799.35 and 527,315.95 USD respectively. These values represent the economic losses which can be reallocated into the public budgets which the Thai and Indonesian governments can spend on more economically productive activities.

(ii) According to the estimation results of the amount of FW, categories of FW, and the estimated Tobit model, SWU and UGM can play an essential role in the household FW reduction through campaigns, training, and promotion about the issues of FW as follows: "Good Guide to Food Consumption Management for Meat, Eggs, Vegetables, Fruit, and Rice and noodles", "How to Minimize the Meal Leftovers in the Household", and "Moral Attitude as a Key Factor to Household Food Waste Reduction". The target group should be focused on the head of household who is mainly in charge of food consumption at home or the wife of the head of household who has characteristics as follows: Young, High Food Expenditures per Month, Big Number of Family Members, and Living in Rural Area.

(3) Food Consumption Management (FCM)

(i) Although FCM in both cases is good and very good, the average scores of the variable of Preparing and Storage in both cases are relatively low when compared to all

variables. Therefore, the training on FCM for the head of household who is mainly in charge of food consumption at home or the wife of the head of household should be focused on Preparing and Storage to reduce FW.

(ii) Based on the results of FCM, within the variables, the top three indicators showing high average scores can be used for the proposal of FCM conceptual framework in order to support SWU and UGM households' responsible consumption as the SDG 12 targets. The information on conceptual framework is depicted in Figure 5.3. Also, it can be adjusted for other cases in ASEAN countries.

Before Cooking or Eating

Planning:
- Planning to buy as family needs to reduce leftovers.
- Adjusting the quantity of cooked food according to the number of family members.
- Shopping according to the capacity of family food storage.

Providing:
- Cooking the ingredients available in the refrigerator before buying more.

Preparing:
- Don't follow the principle of "it's better to have leftovers than serving less food".
- Don't throw away fruit or vegetables with holes or not smooth.
- Cooking for the amount my family needs.
- Using existing ingredients in the food preparation process.

After Cooking or Eating

Serving/Processing:
- Eating leftover which is still in a good condition either in the same form or reheated.
- Processing leftover into other forms of food.
- Trying to cook at home food for kids.
- Adjusting cook planning by taking into account the leftovers.

Storage:
- Arranging food by expiration date.
- Eating food before its quality decreases.
- Checking regularly about the foods expired date in storage.
- Remembering leftovers keeping in the fridge/refrigerator even it is messy and full.

Food waste disposal/usage:
- Sharing food with neighbors/friends/relatives whenever having excess food.
- Sharing food with neighbors/friends/relatives whenever cooking too much.
- Using food leftovers to feed pets/livestock.

Figure 5.3 Proposal of Conceptual Framework for Food Consumption Management in the Cases of SWU and UGM

References

Abdelradi, F. (2018). Food waste behavior at the household level: A conceptual framework. *Waste Management*, *71*, 485-493. https://doi:10.1016/j.wasman.2017.10.001

Abeliotis, K., Lasaridi, K., & Chroni, C. (2016). Food waste prevention in Athens, Greece: The effect of family characteristics. *Waste Management and Research*, *34*(12), 1210-1216. https://doi:10.1177/0734242X16672318

Adam, A. M. (2020). Sample Size Determination in Survey Research. *Journal of Scientific Research and Reports*, *26*(5), 90–97. https://doi.org/10.9734/jsrr/2020/v26i530263

Aka, S., & Buyukdag, N. (2021). How to prevent food waste behavior? A deep empirical research. *Journal of Retailing and Consumer Services*, *61*(March), 1–12. https://doi.org/10.1016/j.jretconser.2021.102560

Aktas, E., Sahin, H., Topaloglu, Z., Oledinma, A., Huda, A. K. S., Irani, Z., Sharif, A. M., van't Wout, T., & Kamrava, M. (2018). A consumer behavioural approach to food waste. *Journal of Enterprise Information Management*, *31*(5), 658–673. https://doi.org/10.1108/JEIM-03-2018-0051

Akuntenda, E. A. 2017. Theories and Concepts for Human Behavior in Environmental Preservation. *Journal of Environmental Science and Public Health*, *1*(2): 120-133. https://doi.org/10.26502/JESPH.012

Ananda, J., Karunasena, G. G., Mitsis, A., Kansal, M., & Pearson, D. (2021). Analyzing behavioral and socio-demographic factors and practices influencing Australian household food waste. *Journal of Cleaner Production*, *306*(April), 1–17. https://doi.org/10.1016/j.jclepro.2021.127280

Ananda, J., Karunasena, G. G., & Pearson, D. (2022). Has the COVID-19 pandemic changed household food management and food waste behavior ? A natural experiment using propensity score matching. *Journal of Environmental Management*, *328*(October 2022), 116887. https://doi.org/10.1016/j.jenvman.2022.116887

Amicarelli, V., & Bux, C. (2021). Food waste in Italian households during the Covid-19 pandemic: a self-reporting approach. *Food Security*, *13*(1), 25–37. https://doi.org/10.1007/s12571-020-01121-z

Amicarelli, V., Lagioia, G., Sampietro, S., & Bux, C. (2021). Has the COVID-19 pandemic changed food waste perception and behavior? Evidence from Italian consumers. Socio-Economic Planning Sciences, June, 1–10. https://doi.org/10.1016/j.seps.2021.101095

Aprilia, A., Tezuka, T., & Spaargaren, G. (2013). Inorganic and Hazardous Solid Waste Management: Current Status and Challenges for Indonesia. Procedia Environmental Sciences, 17(81), 640–647. https://doi.org/10.1016/j.proenv.2013.02.080

Aschemann-Witzel, J., de Hooge, I. E., & Almli, V. L. (2021). My style, my food, my waste! Consumer food waste-related lifestyle segments. *Journal of Retailing and Consumer Services*, *59*(October 2020), 1–12. https://doi.org/10.1016/j.jretconser.2020.102353

Attiq, S., Danish Habib, M., Kaur, P., Junaid Shahid Hasni, M., & Dhir, A. (2021). Drivers of food waste reduction behavior in the household context. *Food Quality and Preference*, 1–35. https://doi.org/10.1016/j.foodqual.2021.104300

Aydin, A. E., & Yildirim, P. (2021). Understanding food waste behavior: The role of morals, habits and knowledge. *Journal of Cleaner Production*, *280*, 1–14. https://doi.org/10.1016/j.jclepro.2020.124250

Azwar, S. 2017. Dasar-dasar Psikometrika. Pustaka Pelajar. Yogyakarta.

_____. 2015. Sikap Manusia Teori dan Pengukurannya. Pustaka Pelajar. Yogyakarta.

Babbitt, C. W., Babbitt, G. A., & Oehman, J. M. (2021). Behavioral impacts on residential food provisioning, use, and waste during the COVID-19 pandemic. *Sustainable Production and Consumption*, *28*, 315–325. https://doi.org/10.1016/j.spc.2021.04.012

Babucea, A. (2007). Methodological Aspects in Using Pearson Coefficient in Analyzing Social and Economical Phenomena, *XI*.

Barker, H., Shaw, P. J., Richards, B., Clegg, Z., & Smith, D. M. (2023). Towards Sustainable Food Systems: Exploring Household Food Waste by Photographic Diary in Relation to Unprocessed, Processed and Ultra-Processed Food. *Sustainability*, *15*(3), 2051. *https://doi.org/10.3390/su15032051*

Barone, A. M., Grappi, S., & Romani, S. (2019). The road to food waste is paved with good intentions: When consumers' goals inhibit the minimization of household food waste. *Resources, Conservation and Recycling*, *149*(June), 97–105. https://doi.org/10.1016/j.resconrec.2019.05.037

Blas, A., Garrido, A., & Willaarts, B. (2018). Food consumption and waste in Spanish households: Water implications within and beyond national borders. *Ecological Indicators*, 89, 290-300. https://doi:10.1016/j.ecolind.2018.01.057

Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior*, *36*(1), 3–15. https://doi.org/10.1002/job.1960

Borrello, M., Caracciolo, F., Lombardi, A., Pascucci, S., & Cembalo, L. (2017). Consumers' perspective on circular economy strategy for reducing food waste. *Sustainability (Switzerland)*, *9*(1). https://doi:10.3390/su9010141

Bravi, L., Francioni, B., Murmura, F., & Savelli, E. (2020). Factors affecting household food waste among young consumers and actions to prevent it. A comparison among the UK, Spain and Italy. *Resources, Conservation and Recycling*, *153*(November 2019), 1–15. https://doi.org/10.1016/j.resconrec.2019.104586

Bunditsakulchai, P., & Liu, C. (2021). Integrated Strategies for Household Food Waste Reduction in Bangkok. *Sustainability, 13*, 1-21. https://doi.org/10.3390/su13147651

Burlea-Schiopoiu, A., Ogarca, R. F., Barbu, C. M., Craciun, L., Baloi, I. C., & Mihai, L. S. (2021). The impact of COVID-19 pandemic on food waste behavior of young people. *Journal of Cleaner Production*, *294*, 1–13. https://doi.org/10.1016/j.jclepro.2021.126333

Cahyani, F. A., Wulandari, P., & Putri, N. A. (2022). Food waste management regulation in Indonesia to achieve sustainable development goals. *IOP Conference Series: Earth and Environmental Science*, *978*(1). https://doi.org/10.1088/1755-1315/978/1/012022

Cahyanti, P. A. B., Widiastuti, K., Agus, C., Noviyani, P., & Kurniawan, K. R. (2019). Development of an edutainment shaft garden for integrated waste management in the UGM green campus. *IOP Conference Series: Earth and Environmental Science*, *398*(1). https://doi.org/10.1088/1755-1315/398/1/012001

Chen, C. C., Sujanto, R. Y., Tseng, M. L., Fujii, M., & Lim, M. K. (2021). Sustainable consumption transition model: Social concerns and waste minimization under willingness-to-pay in Indonesian food industry. *Resources, Conservation and Recycling*, *170*(February), 105590. https://doi.org/10.1016/j.resconrec.2021.105590

Christine, Aliefia, D., Syaputra, G. E., Novella, U., Yamazaki, A., Nakatsuka, K., & Fujiyama, I. (2021). Awareness before and during Pandemic toward Food Waste: "comparison between Indonesia and Japanese Students. *IOP Conference Series: Earth and Environmental Science*, *933*(1). https://doi.org/10.1088/1755-1315/933/1/012023

Clark, J. & Manning, L. (2017). What are the factors that an opportunity sample of UK students insinuate as being associated with their wastage of food in the home setting?. *Resources, Conservation and Recycling*, *130*, 20-30.

Damanhuri, E., Wahyu, I. M., Ramang, R., & Padmi, T. (2009). Evaluation of municipal solid waste flow in the Bandung metropolitan area, Indonesia. *Journal of Material Cycles and Waste Management*, *11*(3), 270–276. https://doi.org/10.1007/s10163-009-0241-9

Department of Environmental Quality Promotion. (2018). *A study of the level of waste management behavior of Thai people*. (in Thai) Retrieved from https://datacenter.deqp.go.th/media/images/2/96/Final_Report_Waste_Beh_V1_เมย_2561.pdf

Dhokhikah, Y., Trihadiningrum, Y., & Sunaryo, S. (2015). Community participation in household solid waste reduction in Surabaya, Indonesia. *Resources, Conservation and Recycling*, *102*, 153–162. https://doi.org/10.1016/j.resconrec.2015.06.013

Diaz-Ruiz, R., Costa-Font, M., & Gil, J. M. (2018). Moving ahead from food-related behaviors: an alternative approach to understand household food waste generation. *Journal of Cleaner Production*, *172*, 1140–1151. https://doi.org/10.1016/j.jclepro.2017.10.148

Fami, H. S., Aramyan, L. H., Sijtsema, S. J., & Alambaigi, A. (2019). Determinants of household food waste behavior in Tehran city: A structural model. *Resources, Conservation and Recycling*, *143*(January), 154–166. https://doi.org/10.1016/j.resconrec.2018.12.033

Farr-Wharton, G., Foth, M., & Choi, J. H.-J. (2014). Identifying factors that promote consumer behaviours causing expired domestic food waste. *Journal of Consumer Behaviour*, *13*, 393–402. https://doi.org/10.1002/cb

Fathoni, K., Utomo, A. P. Y., Prasetiyo, B., & Retnoningsih, A. (2021). Integrated waste management system in Universitas Negeri Semarang, Indonesia. *Journal of Physics: Conference Series*, *1918*(5). https://doi.org/10.1088/1742-6596/1918/5/052087

Florkowski, W. J., Us, A., & Klepacka, A. M. (2018). Food waste in rural households supports local biogas production in Lubelskie Voivodship (Poland). *Resources, Conservation and Recycling*, *136*, 46-52. https://doi:10.1016/j.resconrec.2018.03.022

Fox, D., Ioannidi, E., Sun, Y. T., Jape, V. W., Bawono, W. R., Zhang, S., & Perez-Cueto, F. J. A. (2018). Consumers with high education levels belonging to the millennial generation from Denmark, Greece, Indonesia and Taiwan differ in the level of knowledge on food waste. *International Journal of Gastronomy and Food Science*, *11*(February 2017), 49–54. https://doi.org/10.1016/j.ijgfs.2017.11.005

Gerald, B. (2018). A Brief Review of Independent, Dependent and One Sample t-test. *International Journal of Applied Mathematics and Theoretical Physics*, *4*(2), 50. https://doi.org/10.11648/j.ijamtp.20180402.13

Gaiani, S., Caldeira, S., Adorno, V., Segrè, A., & Vittuari, M. (2017). Food wasters: Profiling consumers' attitude to waste food in Italy. *Waste Management*. https://doi:10.1016/j.wasman.2017.11.012

Gojard, S., Masson, M., Blumenthal, D., & Véron, B. (2021). To keep or not to keep? Sorting out leftovers from a refrigerator. *Appetite*, *165*(May), 1–11. https://doi.org/10.1016/j.appet.2021.105312

Gujarati, D.N. and D.C. Porter. 2009. Basic Econometrics. The McGraw-Hill.

Hadiningrat, G. (2020). Women's Role in Food Waste Management in Indonesia (Study Case in Bandung). *Proceedings of the 1st International Scientific Meeting on Public Health and Sports*, *31*(Ismophs 2019), 31–35.

Hebrok, M., & Boks, C. (2017). Household food waste: Drivers and potential intervention points for design – An extensive review. *Journal of Cleaner Production*, *151*, 380-392. https://doi:10.1016/j.jclepro.2017.03.069

Hussaro, K., Intanin, J., & Teekasap, S. (2017). Biogas Production from food waste and vegetable waste for the Sakaew Temple Community Angthong Province Thailand. *GMSARN International Journal, 11*(2), 82-89.

Imsa-ard, P. (2020). Thai University Students' Perceptions towards the Abrupt Transition to 'Forced' Online Learning in the COVID-19 Situation. *Journal of Education Khon Kaen University, 43*, 30-44. (in Thai)

Ingram, J. S. I., Wright, H. L., Foster, L., Aldred, T., Barling, D., Benton, T. G., Berryman, P. M., Bestwick, C. S., Bows-Larkin, A., Brocklehurst, T. F., Buttriss, J., Casey, J., Collins, H., Crossley, D. S., Dolan, C. S., Dowler, E., Edwards, R., Finney, K. J., Fitzpatrick, J. L., … Sutherland, W. J. (2013). Priority research questions for the UK food system. *Food Security*, *5*, 617–636. https://doi.org/10.1007/s12571-013-0294-4

Jeamponk, P. (2012). *The Study of Solid Waste Utility and Household Management at Suanluang Sub-District, Amphawa District, Samut Songkram Province*. (in Thai) Retrieved from http://www.ssruir.ssru.ac.th/bitstream/ssruir/643/1/050-55.pdf

Jeznach, M., Bilska, B., Tul-Krzyszczuk, A., & Pawlak, A. (2017). The role of active packages in restricting waste of meat in households. *Zywnosc. Nauka. Technologia. Jakosc/Food. Science Technology. Quality*, *24*(4), 126-136. https://doi:10.15193/zntj/2017/113/216

Jribi, S., Ben Ismail, H., Doggui, D., & Debbabi, H. (2020). COVID-19 virus outbreak lockdown: What impacts on household food wastage?. *Environment, Development and Sustainability*, *22*(5), 3939-3955. https://doi.org/10.1007/s10668-020-00740-y

Khaeongmueang, P. (2019). *Household Solid Waste Management of People in Wangsaeng Sub-District, Kaedam District, Mahasarakham Province* (Master of Public Administration), Rajabhat Maha Sarakham University (in Thai) Retrieved from http://fulltext.rmu.ac.th/fulltext/2563/M128745/Khaeongmueang%20Phichay.pdf

Khair, H., Rachman, I., & Matsumoto, T. (2019). Analyzing household waste generation and its composition to expand the solid waste bank program in Indonesia: a case study of Medan City. *Journal of Material Cycles and Waste Management*, *21*(4), 1027–1037. https://doi.org/10.1007/s10163-019-00840-6

Khongpirun, W., Thiphom, S., & Chanthorn, W. (2017). Factors Associated with Waste Management Behaviors among Pongpa Village, Kaeng Sopha Sub-district, Wang Thong District, Phitsanulok Province, Thailand. *Journal of Health Science 26*, 12. (in Thai)

Kirdklinhom, S. (2019). *Guidelines for Public Participation in Municipal Solid Waste Management: Nakhon Si Thammarat Municipality.* (Master of Science (Environmental Management)), National Institute of Development Administration, (in Thai) Retrieved from https://repository.nida.ac.th/bitstream/handle/662723737/5114/b2106924.pdf?sequence=1&isAllowed=y

Koido, K., Takeuchi, H., & Hasegawa, T. (2018). Life cycle environmental and economic analysis of regional-scale food-waste biogas production with digestate nutrient management for fig fertilisation. *Journal of Cleaner Production, 190*, 552-562. https://doi:10.1016/j.jclepro.2018.04.165

Koivupuro, H. K., Hartikainen, H., Silvennoinen, K., Katajajuuri, J. M., Heikintalo, N., Reinikainen, A., & Jalkanen, L. (2012). Influence of socio-demographic, behavioral and attitudinal factors on the amount of avoidable food waste generated in Finnish households. *International Journal of Consumer Studies*, *36*(2), 183–191. https://doi.org/10.1111/j.1470-6431.2011.01080.x

Kurniawan, T. A., Avtar, R., Singh, D., Xue, W., Dzarfan Othman, M. H., Hwang, G. H., Iswanto, I., Albadarin, A. B., & Kern, A. O. (2021). Reforming MSWM in Sukunan (Yogyakarta, Indonesia): A case-study of applying a zero-waste approach based on circular economy paradigm. *Journal of Cleaner Production*, *284*, 1–13. https://doi.org/10.1016/j.jclepro.2020.124775

Kusumawanto, A., & Setyowati, M. (2019). Green engineering for Waste Management System in University-A Case Study of Universitas Gadjah Mada, Indonesia. In *Green Engineering for Campus Sustainability* (pp. 145–161). Springer Nature. https://doi.org/10.1007/978-981-13-7260-5

Lamorte, Wayne, W. 2019. The Theory of Planned Behavior. accessed in 18th august 2022 https://sphweb.bumc.bu.edu/otlt/mph-modules/sb/behavioralchangetheories/BehavioralChangeTheories3.html

Lanfranchi, M. (2016). Household food waste and eating behavior: empirical survey. *British Food Journal*, *118*(12), 1–18. https://doi.org/10.1108/eb011695

Laohalidanond, K., & Kerdsuwan, S. (2021). Green energy recovery from waste in Thailand: Current situation and perspectives. *International Journal of Energy for a Clean Environment, 22*(5), 103-122. https://doi:10.1615/INTERJENERCLEANENV.2021037107

Lebersorger, S., & Schneider, F. (2011). Discussion on the methodology for determining food waste in household waste composition studies. *Waste Management*, *31*(9–10), 1924–1933. https://doi.org/10.1016/j.wasman.2011.05.023

Li, Y., Wang, L. en, Liu, G., & Cheng, S. (2021). Rural household food waste characteristics and driving factors in China. *Resources, Conservation and Recycling*, *164*(May 2020), 105209. https://doi.org/10.1016/j.resconrec.2020.105209

Liu, C., Bunditsakulchai, P., & Zhuo, Q. (2021). Impact of covid-19 on food and plastic waste generated by consumers in Bangkok. *Sustainability (Switzerland), 13*(16). https://doi:10.3390/su13168988

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*. https://doi:10.1016/j.resconrec.2020.104779

Lusk, J. L., & Ellison, B. (2017). A note on modeling household food waste behavior. *Applied Economics Letters*, 24(16), 1199-1202. https://doi:10.1080/13504851.2016.1265070

Lyndhurst, B., Cox, J., & Downing, P. (2007). Food Behavior Consumer Research: Quantitative Phase. *Waste & Resources Action Programme (WRAP)*, *December 2006*, 1–36.

Maruean, I., Chumsang, C., & Pattra, S. (2013). A Model of Waste Management in Accordance with Hill Tribe Sociological in Paklang Subdistrict Pua District Nan Province. *KKU Journal for Public Health Research, 6*(2), 9. (in Thai)

Mattar, L., Abiad, M. G., Chalak, A., Diab, M., & Hassan, H. (2018). Attitudes and behaviors shaping household food waste generation: Lessons from Lebanon. *Journal of Cleaner Production*, *198*, 1219–1223. https://doi.org/10.1016/j.jclepro.2018.07.085

McCarthy, B., & Liu, H. B. (2017). Food waste and the 'green' consumer. *Australasian Marketing Journal, 25*(2), 126-132. https://doi:10.1016/j.ausmj.2017.04.007

Mganga, P., Syafrudin, S., & Amirudin, A. (2021). A Survey of Students' Awareness on Food Waste Problems and Their Behaviour Towards Food Wastage: a Case Study of Diponegoro University (UNDIP), Indonesia. *E3S Web of Conferences*, *317*, 01071. https://doi.org/10.1051/e3sconf/202131701071

Milne, R. (2012). Arbiters Of Waste: Date Labels, The Consumer And Knowing Good, Safe Food. *Sociological Review*, *60*(S2), 84–101. https://doi.org/10.1111/1467-954X.12039

Minten, B., & Reardon, T. (2008). Food prices, quality, and quality's pricing in supermarkets versus traditional markets in developing countries. *Review of Agricultural Economics*, *30*(3), 480–490. https://doi.org/10.1111/j.1467-9353.2008.00422.x

Mulyo, J. H., Widada, A. W., Perwitasari, H., Sugiyarto, & Rohmah, F. (2022). The Effect of Food Consumption Management on the Reduction of Food Waste in Indonesia. *IOP Conference Series: Earth and Environmental Science*, *1005*(1), 012025. https://doi.org/10.1088/1755-1315/1005/1/012025

Muqarrabin, A. M. 2017. Teori yang Digunakan untuk Mengukur Perilaku Konsumen-Theory of Reasoned Action. accessed in 18th august 2022 TEORI YANG BIASA DIGUNAKAN UNTUK MENGUKUR PERILAKU KONSUMEN – Theory of Reasoned Action – Global Business Marketing (binus.ac.id)

Neff, R. A., Spiker, M. L., & Truant, P. L. (2015). Wasted food: U.S. consumers' reported awareness, attitudes, and behaviors. *PLoS ONE*, *10*(6). https://doi:10.1371/journal.pone.0127881

Newman, B., Khawsaad, J., & Sorndee, K. (2016). *The Study on Quantity and Composition of Food Waste in Srinakharinwirot University (Ongkharak) for Estimation of Biogas Production Potential*. (in Thai) Retrieved from http://ir.swu.ac.th/jspui/bitstream/123456789/5053/2/PRO2365.pdf

Nguyen, T. T. T., Malek, L., Umberger, W. J., & O'Connor, P. J. (2022). Household food waste disposal behaviour is driven by perceived personal benefits, recycling habits and ability to compost. *Journal of Cleaner Production*, *379*(P1), 134636. https://doi.org/10.1016/j.jclepro.2022.134636

Nunkoo, R., Bhadain, M., & Baboo, S. (2021). Household food waste: attitudes, barriers and motivations. *British Food Journal*. https://doi.org/10.1108/BFJ-03-2020-0195

Ounsaneha, W., Suksaroj, T. T., & Rattanapan, C. (2019). Choice of food waste management for a large vegetable market in Thailand. *International Journal of Environmental Science and Development, 10*(3), 100-103. http://doi:10.18178/ijesd.2019.10.3.1155

Ozili, Peterson and Arun, Thankom. 2020. Spillover of COVID-19: Impact on the Global Economy. https://mpra.ub.uni-muenchen.de/99850/

Pamela, Nugraha, A., Aritonang, M., & Hutajulu, J. P. (2019). Determinants of household food waste value in Indonesia: A study case on high education level parents. *IOP Conference Series: Earth and Environmental Science*, *399*(1). https://doi.org/10.1088/1755-1315/399/1/012121

Padmo, D., Sri Ardiasih, L., & Idrus, O. (2020). Online Learning During the Covid-19 Pandemic and Its Effect on Future Education in Indonesia. In Ljupka Naumovska (Ed.), The Impact of COVID19 On the International Education System (pp.71-86). Proud Pen.

Parfitt, J., Barthel, M., & MacNaughton, S. (2010). Food waste within food supply chains: Quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *365*(1554), 3065–3081. https://doi.org/10.1098/rstb.2010.0126

Parizeau, K., von Massow, M., & Martin, R. C. (2021). Directly observing household food waste generation using composition audits in a Canadian municipality. *Waste Management*, *135*(August), 229–233. https://doi.org/10.1016/j.wasman.2021.08.039

Pelt, A., Saint-Bauzel, R., Barbier, L., & Fointiat, V. (2020). Food waste: Disapproving, but still doing. An evidence-based intervention to reduce waste at households. *Resources, Conservation and Recycling*, *162*(December 2019), 105059. https://doi.org/10.1016/j.resconrec.2020.105059

Ponis, S. T., Papanikolaou, P. A., Katimertzoglou, P., Ntalla, A. C., & Xenos, K. I. (2017). Household food waste in Greece: A questionnaire survey. *Journal of Cleaner Production*, 149, 1268-1277. https://doi:10.1016/j.jclepro.2017.02.165

Priefer, C., Jörissen, J., & Bräutigam, K. R. (2016). Food waste prevention in Europe - A cause-driven approach to identify the most relevant leverage points for action. *Resources, Conservation and Recycling*, *109*, 155–165. https://doi.org/10.1016/j.resconrec.2016.03.004

Principato, L., Secondi, L., & Pratesi, C. A. (2015). Reducing food waste: An investigation on the behavior of Italian youths. *British Food Journal*, *117*(2), 731–748. https://doi.org/10.1108/BFJ-10-2013-0314

Principato, L., Secondi, L., Cicatiello, C., & Mattia, G. (2020). Caring more about food: The unexpected positive effect of the Covid-19 lockdown on household food management and waste. *Socio-Economic Planning Sciences*, *September*, 100953. https://doi.org/10.1016/j.seps.2020.100953

Ortiz-Gonzalo, D., Ørtenblad, S. B., Larsen, M. N., Suebpongsang, P., & Bruun, T. B. (2021). Food loss and waste and the modernization of vegetable value chains in Thailand. *Resources, Conservation and Recycling, 174*. https://doi:10.1016/j.resconrec.2021.105714

Qi, D., & Roe, B. E. (2016). Household food waste: Multivariate regression and principal components analyses of awareness and attitudes among u.s. consumers. *PLoS ONE*, *11*(7), 1–19. https://doi.org/10.1371/journal.pone.0159250

Qian, L., Li, F., Cao, B., Wang, L., & Jin, S. (2021). Determinants of food waste generation in Chinese university canteens: Evidence from 9192 university students. *Resources, Conservation and Recycling*, *167*(January), 1–13. https://doi.org/10.1016/j.resconrec.2021.105410

Qonitan, F. D., Wayan Koko Suryawan, I., & Rahman, A. (2021). Overview of Municipal Solid Waste Generation and Energy Utilization Potential in Major Cities of Indonesia. *Journal of Physics: Conference Series*, *1858*(1). https://doi.org/10.1088/1742-6596/1858/1/012064

Raharjo, S., Ruslinda, Y., Bachtiar, V. S., Regia, R. A., Fadhil, M., Rachman, I., & Matsumoto, T. (2018). Investigation on Municipal Solid Waste Characteristics from Commercial Sources and Their Recycling Potential in Padang City, Indonesia. *IOP Conference Series: Materials Science and Engineering*, *288*(1). https://doi.org/10.1088/1757-899X/288/1/012134

Rado, I. (2022). Getting to the bottom of food waste: identifying obstacles to effective circular economy practices in a Thai semi-urban context. *Journal of Material Cycles and Waste Management, 24*(2), 824-834. https://doi:10.1007/s10163-021-01347-9

Resnick, D., Grebmer K. V., Bernstein, J., Wiemers, M., reiner, L., & Bachmeier, M. (2022). *Global hunger index: Food systems transformation and local governance*. Welthungerhilfeconcern Worldwide. https://www.globalhungerindex.org/pdf/en/2022.pdf

Richter, B., & Bokelmann, W. (2018). The significance of avoiding household food waste – A means-end-chain approach. *Waste Management*, *74*, 34-42. https://doi:10.1016/j.wasman.2017.12.012

Riverso, R., Amato, M., & La Barbera, F. (2017). The effect of food waste habits on future intention to reduce household food waste. Quality - *Access to Success*, *18*, 369-375.

Sangmala, A., Naemchanthara, P., Limsuwan, P., & Naemchanthara, K. (2021). Replacement of hydroxyapatite from chicken eggshell waste for ceramic properties improvement. *International Journal of Applied Ceramic Technology, 18*(6), 2132-2142. https://doi:10.1111/ijac.13862

Saliem, H. P., Mardianto, S., Sumedi, Suryani, E., & Widayanti, S. M. (2021). Policies and strategies for reducing food loss and waste in Indonesia. *IOP Conference Series: Earth and Environmental Science*, *892*(1). https://doi.org/10.1088/1755-1315/892/1/012091

Schanes, K., Dobernig, K., & Gözet, B. (2018). Food waste matters - A systematic review of household food waste practices and their policy implications. *Journal of Cleaner Production*, *182*(February), 978–991. https://doi.org/10.1016/j.jclepro.2018.02.030

Secondi, L., Principato, L., & Laureti, T. (2015). Household food waste behaviour in EU-27 countries: A multilevel analysis. *Food Policy*, *56*, 25–40. https://doi.org/10.1016/j.foodpol.2015.07.007

See-mook, S. (2021). *Food Waste Problem and Management*. (in Thai) Retrieved from https://www.senate.go.th/assets/portals/1/news/6588/2_เล่มเต็มบทความ00101464.pdf

Sekito, T., Dote, Y., & Hindarman, R. R. (2019). Solid waste flow and composition determination for sustainable waste management in Gili Trawangan, Indonesia. *SN Applied Sciences*, *1*(11), 1–10. https://doi.org/10.1007/s42452-019-1369-4

Septianto, F., Kemper, J. A., & Northey, G. (2020). Thanks, but no thanks: The influence of gratitude on consumer awareness of food waste. *Journal of Cleaner Production*, 258, 1–14. https://doi.org/10.1016/j.jclepro.2020.120591

Setti, M., Banchelli, F., Falasconi, L., Segrè, A., & Vittuari, M. (2018). Consumers' food cycle and household waste. When behaviors matter. *Journal of Cleaner Production*, *185*, 694–706. https://doi.org/10.1016/j.jclepro.2018.03.024

Setti, M., Falasconi, L., Segrè, A., Cusano, I., & Vittuari, M. (2016). Italian consumers' income and food waste behavior. *British Food Journal*, *118*(7), 1731-1746. https://doi:10.1108/BFJ-11-2015-0427

Silvennoinen, K., Katajajuuri, J. M., Hartikainen, H., Heikkilä, L., & Reinikainen, A. (2014). Food waste volume and composition in Finnish households. *British Food Journal*, *116*(6), 1058-1068. https://doi:10.1108/BFJ-12-2012-0311

Smith, D. A., & Brame, R. (2003). Tobit models in social science research: Some limitations and a more general alternative. *Sociological Methods and Research*, *31*(3), 364–388. https://doi.org/10.1177/0049124102239080

Srijuntrapun, P. (2016). Integrated Food Waste Reduction in Households. *Silpakorn University Journal, 36*(3), 18. (in Thai) https://doi.org/10.14456/sujthai.2016.11

Soma, T. (2016). The Tale of the Crying Rice: The Role of Unpaid Foodwork and Learning in Food Waste Prevention and Reduction in Indonesian Households. In *Learning, Food, and Sustainability: Sites for Resistance and Change* (pp. 19–34). https://doi.org/10.1057/978-1-137-53904-5

Soma, T. (2017). Gifting, ridding and the "everyday mundane": the role of class and privilege in food waste generation in Indonesia. *Local Environment*, *22*(12), 1444–1460. https://doi.org/10.1080/13549839.2017.1357689

Soma, T. (2020). Space to waste: the influence of income and retail choice on household food consumption and food waste in Indonesia. *International Planning Studies*, *25*(4), 372–392. https://doi.org/10.1080/13563475.2019.1626222

Soma, T., Li, B., & Maclaren, V. (2021). An evaluation of a consumer food waste awareness campaign using the motivation opportunity ability framework. *Resources, Conservation and Recycling*, *168*(August 2020), 1–8. https://doi.org/10.1016/j.resconrec.2020.105313

Somkun, P. N. (2020). Mathematical modeling approach applied to food waste reduction at retailer and consumer levels in food supply chain. In *Food Industry Wastes: Assessment and Recuperation of Commodities* (pp. 409-429).

Susilo, D., De Leon, M. V., Dwi Putranto, T., & Kurnia Hartati, F. (2021). Food waste handling perception in Indonesia: Communicating the sustainability of Food and environment. *IOP Conference Series: Earth and Environmental Science*, *892*(1). https://doi.org/10.1088/1755-1315/892/1/012109

Spector, P. E. (1992). *Summated Rating Scale Construction : An Introduction*. *Adv. Mater.* California: Sage Publications, Inc.

Srijuntrapun, P., & Chaiboonchoe, A. (2021). The Study of Quantity of Household Waste during the Coronavirus (COVID-19) Outbreak. *University of the Thai Chamber of Commerce Journal Humanities and Social Sciences, 41*(2), 17. (in Thai)

Sriyothee, W. (2020). *Development Model of the People's Waste Management Behaviors in Seka District, Bueng Kan Province.* (Master of Public Administration), Sakon Nakhon Rajabhat University, (in Thai) Retrieved from https://gsmis.snru.ac.th/e-thesis/file_att1/2020080860426423118_fulltext.pdf

Stangherlin, I. do C., de Barcellos, M. D., & Basso, K. (2020). The Impact of Social Norms on Suboptimal Food Consumption: A Solution for Food Waste. *Journal of International Food and Agribusiness Marketing*, *32*(1), 30–53. https://doi.org/10.1080/08974438.2018.1533511

Statistic Indonesia. 2023. District/City Monthly Minimum Wage (Rupiah), 2021-2023. Accessed 2th June 2023 https://ntt.bps.go.id/indicator/19/562/1/upah-minimum-kabupaten-kota-umr-sebulan.html

Szabó-Bódi, B., Kasza, G., & Szakos, D. (2018). Assessment of household food waste in Hungary. *British Food Journal*, *120*(3), 625-638. https://doi:10.1108/BFJ-04-2017-0255

Taherdoost, H. (2016). Sampling Methods in Research Methodology ; How to Choose a Sampling Technique for Research Hamed Taherdoost To cite this version : HAL Id : hal-02546796 Sampling Methods in Research Methodology ; How to Choose a Sampling Technique for. *International Journal of Academic Research in Management (IJARM)*, *5*(2), 18–27.

Tangwanichagapong, S., Nitivattananon, V., Mohanty, B., & Visvanathan, C. (2017). Greening of a campus through waste management initiatives. *International Journal of Sustainability in Higher Education, 18*(2), 203-217. https://doi:10.1108/IJSHE-10-2015-0175

Thailand Environment Institute. (2021). *Bangkok's food supply chain for sustainable production and consumption*. (in Thai) Retrieved from http://www.tei.or.th/file/library/Thai_Report_on_SCP_in_Food_52.pdf

Thabpadung, S. (2020). *Factors Affecting Household Solid Waste Reduction Behavior in Subdistrict Administrative Organization without Solid Waste Management, Mueng District, Phitsanulok Province.* (Master in Public Health Program), Naresuan University, (in Thai) Retrieved from http://nuir.lib.nu.ac.th/dspace/bitstream/123456789/2567/3/61062205.pdf

TDRI. (September 2019). *A Study of Suitable Guidelines on the Management of Excess Food to Reduce Food Waste Problems in Thailand*. (in Thai) Retrieved from https://tdri.or.th/wp-content/uploads/2019/09/final_food_waste_management.pdf

Teampanpong, J. (2021). Improper Garbage Management Attracts Vertebrates in a Thai National Park. *Ecoscience, 28*(2), 107-113. https://doi:10.1080/11956860.2021.1872264

Thongplew, N., Duangput, N., & Khodkham, S. (2021). Addressing plate waste and consumption practice at university canteens: realizing green university through citizen-consumers. *International Journal of Sustainability in Higher Education, 22*(7), 1691-1706. https://doi:10.1108/IJSHE-02-2021-0056

Trihadiningrum, Y., Laksono, I. J., Dhokhikah, Y., Moesriati, A., Radita, D. R., & Sunaryo, S. (2017). Community activities in residential solid waste reduction in Tenggilis Mejoyo District, Surabaya City, Indonesia. *Journal of Material Cycles and Waste Management*, *19*(1), 526–535. https://doi.org/10.1007/s10163-015-0440-5

Tucker, C. A., & Farrelly, T. (2016). Household food waste: the implications of consumer choice in food from purchase to disposal. *Local Environment*, *21*(6), 682-706. https://doi:10.1080/13549839.2015.1015972

U-chupaj, V. (2018). *Knowledge and behavior of people in waste management and quality of waste management services of Laoyao Sub-district administrative organization, Ban Hong District, Lamphun province.* (Master of Public Health), ChiangMai Rajabhat University, (in Thai) Retrieved from http://www.graduate.cmru.ac.th/core/km_file/402.pdf

United Nations Environment Programme (2021). *Food Waste Index Report 2021*. Nairobi.

Vanapruk, P. (2011). *Improvement of Municipal Solid Waste Management Policy in Thailand.* (Doctor of Philosophy in Environmental Management), Prince of Songkla University, (in Thai) Retrieved from https://kb.psu.ac.th/psukb/bitstream/2010/8684/1/361220.pdf

van Herpen, E., van Geffen, L., Nijenhuis-de Vries, M., Holthuysen, N., van der Lans, I., & Quested, T. (2019). A validated survey to measure household food waste. *MethodsX*, *6*, 2767-2775. https://doi.org/10.1016/j.mex.2019.10.029

Visschers, V. H. M., Wickli, N., & Siegrist, M. (2016). Sorting out food waste behaviour: A survey on the motivators and barriers of self-reported amounts of food waste in households. *Journal of Environmental Psychology*, *45*, 66–78. https://doi.org/10.1016/j.jenvp.2015.11.007

Vich, D. V., Miyamoto, H. P., Queiroz, L. M., & Zanta, V. M. (2017). Household food-waste composting using a small-scale composter. *Revista Ambiente e Agua*, *12*(5), 718-729. http://doi:10.4136/ambi-agua.1908

Waitt, G., & Phillips, C. (2016). Food waste and domestic refrigeration: a visceral and material approach. *Social and Cultural Geography*, *17*(3), 359–379. https://doi.org/10.1080/14649365.2015.1075580

Yuan, Y., Nomura, H., Takahashi, Y., & Yabe, M. (2016). Model of Chinese household kitchen waste separation behavior: A case study in Beijing City. *Sustainability (Switzerland)*, *8*(10), 1–15. https://doi.org/10.3390/su8101083

Zan, F., Dai, J., Hong, Y., Wong, M., Jiang, F., & Chen, G. (2018). The characteristics of household food waste in Hong Kong and their implications for sewage quality and energy recovery. *Waste Management*, *74*, 63-73. https://doi:10.1016/j.wasman.2017.11.051

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Appendices

Appendix A. Questionnaire

Part I. Food waste awareness

- Individual understanding and awareness about the impact of food waste on health, environment, household economy, society, and culture **(For the student)**

Student information

1. What is your gender? ○ Male ○ Female

2. What is your age? ……years

3. What is your faculty? ……

Perception of FW Reducing Consequences and Its Practical Benefits	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I believe that reducing household food waste is an effective approach to minimize pollution.	○	○	○	○	○
I believe that reducing household food waste contributes to a healthier environment for the next generation (e.g., a pile of food waste will cause air pollution (nitrogen and methane gas) which has a bad impact on newborns around landfills)	○	○	○	○	○
I believe that reducing household food waste is a	○	○	○	○	○

Perception of FW Reducing Consequences and Its Practical Benefits	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I believe that reducing household food waste is a critical component of reducing landfill waste.					
I have enough time to worry about the amount of food wasted.	○	○	○	○	○
Leftover food should be checked to make sure that the food is still edible (e.g. leftover rice needs to be checked whether it is edible or not).	○	○	○	○	○
Throwing away food if the package expiry date has passed reduces the chances someone will get sick from eating the food.	○	○	○	○	○

Health Awareness	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I believe that eating expired food will increase the possibility of being sick (e.g., consuming expired bread will cause a stomachache).	○	○	○	○	○
I'm worried that eating recooked leftovers (e.g., recooking leftover rice into fried rice) can damage my health.	○	○	○	○	○

Health Awareness	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
In my opinion, eating leftovers is harmful.	○	○	○	○	○

Economic Awareness	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I know that food waste causes economic problems (e.g., food waste in large quantity will require a higher cost to manage).	○	○	○	○	○
Throwing away food is a major source of waste money.	○	○	○	○	○
I can save money by reducing food waste (e.g., buying food as needed will reduce food waste and save money).	○	○	○	○	○
Overconsumption contributes to high prices of food.	○	○	○	○	○
I can help control the prices of food by avoiding wastage.	○	○	○	○	○
Overconsumption increases the prices of goods.	○	○	○	○	○

Socio-cultural Awareness and Food Waste Guilt	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I try to remind my friends, family, and people around me about the need to reduce food waste.	○	○	○	○	○
I think everyone should share the responsibility to reduce food waste.	○	○	○	○	○
People who are important to me (parents, friends, girl/boyfriend) consider my efforts to reduce the amount of food wasted.	○	○	○	○	○
When I try to reduce the leftover food, people who are important to me (parents, friends, girl/boyfriend) tend to follow my eating habit.	○	○	○	○	○
I don't mind if my guests eat all the food I have prepared for them.	○	○	○	○	○
I rarely buy lots of fresh products to eat.	○	○	○	○	○
I feel guilty for throwing away food.	○	○	○	○	○
I feel guilty for generating food waste while many people do not have guaranteed access to edible food.	○	○	○	○	○
I feel guilty for generating food waste because it has negative	○	○	○	○	○

Socio-cultural Awareness and Food Waste Guilt	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
effects on the environment, economy, and society.					

Environmental Awareness	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I have knowledge about the purchase of environmentally friendly products (organic rice, organic vegetables, and organic fruits).	○	○	○	○	○
I have knowledge about food waste recycling (composting food waste) and reusing leftover food (recooking leftover rice into fried rice).	○	○	○	○	○
I have knowledge of the purchase of waste-reduction packaging.	○	○	○	○	○
I have knowledge of environmental labeling (e.g., organic ingredient labels, and eco-friendly labels).	○	○	○	○	○
I have knowledge about a variety of environmental issues (e.g., food waste represents a great waste of freshwater and groundwater resources).	○	○	○	○	○

Environmental Awareness	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I know that reducing food waste can reduce environmental hazards (e.g., saving the land, water, and energy that would have been used to make it).	○	○	○	○	○
I know that food waste causes environmental pollution (e.g., food waste produces a large amount of methane, which is more dangerous than CO2).	○	○	○	○	○

Food Waste Reduction Potential	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
My household food waste is equal to other households of my size.	○	○	○	○	○
It would be easy to reduce food waste further.	○	○	○	○	○
I tend to throw away less leftover food when I buy food in large quantity (e.g., buying vegetables in large quantity will tend to produce leftovers which are then thrown away).	○	○	○	○	○
I plan to reduce household food waste by learning more about the negative impacts of food waste	○	○	○	○	○

Food Waste Reduction Potential	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
(e.g., increasing air pollution and wasting money).					

Part II. Determinants of food waste generation

- Socio-economic data, the amount of food that is discarded, personal habits, shopping habits, and consumption product characteristics**. For someone who is in charge of planning the food menu for family members (housewives or husbands).**

Socio-economic data

1. What is your gender? ○ Male ○ Female
2. What is your age? ……years
3. What is your last education? ……
4. What is your marital status? (*Please select one*)
   ○ Single ○ Married ○ Widowed
5. How many household members are there in your household?
   …… persons

6. How many children (under 18 years old) are there in your household? (Thailand under 18 years, Indonesia under 17 years)
   …… persons

7. How many elderly people (over 60 years old) are there in your household?
   …… persons

8. Which is the geographic area of your house? (*Please select one*)
   ○ Rural area ○ Urban area
9. How much is the rough figure of monthly income the household receives?
   ……
10. How much is the rough figure for monthly expenditure the household spends?
    ……

11. How much is the rough figure for monthly food expenditure the household spends?

……

Food waste data

Four questions about food and drink consumption are used for someone who is in charge of planning the food menu for family members (housewive or husband). The data on answers will be derived from the household consumption of 24 hours ago.

1. In your household, what was the breakfast composed yesterday, and how much was it? (*Example answer: Five plates of rice, One big bowl of chicken curry, One plate of stir-fried vegetables, Two cups of coffee, Three drinks of milk, and Two drinks of juice.*)

……
……
……
……

2. In your household, what was the lunch composed yesterday and how much was it? (*Example answer: Two plates of chicken and vegetable-fired rice with sunny-side up egg, Three bowls of noodle soups, Two glasses of iced coffees, and Three cans of Coca-Cola.*)

……
……
……
……

3. In your household, what was the dinner composed yesterday and how much was it? (*Example answer: Five plates of rice, fried fish, One bowl of spicy chicken soup, One set of shrimp paste chili sauce with vegetables, Two cups of coffee, and Three glasses of cool water.*)

……
……
……
……

4. In your household, what were the snacks composed yesterday and how much was it? (*Example answer:* Half of a plate of pineapple and watermelon, One pack of crackers, Two cups of yogurt, and a Half pack of potato chips.)

……
……
……
……

The questions about food waste are for 24-hour recall of the housewives/husband (Food waste household for 24 hours)

We split food waste into four categories, which are explained below. Please read this carefully as these categories will be used in the next questions!

(i) Completely unused foods: foods that are disposed of which have not been used at all.

(ii) Partly used foods: foods that are disposed of after it has been partly used.

(iii) Meal leftovers: leftovers that are disposed of after these are left on the plate, pot, pan, or bowl.

(iv) Leftovers after storing meals: leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment.

5. In your household, did you dispose of rice and noodles including their products yesterday?

○ Yes, I did. (*Please continue to answer question number 6 and 7*)

○ No, I didn't. (*Please skip to answer question number 8*)

6. In your household, how much rice and noodle were disposed of yesterday? (*One normal serving rice ladle equals approximately 60 grams.*)

○ Less than half serving rice ladle
○ Half serving rice ladle
○ 1 serving rice ladle
○ 2 to 3 serving rice ladles
○ 4 to 5 serving rice ladles
○ 6 to 7 serving rice ladles
○ More than 7 serving rice ladles

7. In your household, to which category did the **majority** of the disposed of rice and noodle belong?

○ **Completely unused foods**: rice and noodle that is disposed of which has not been used at all (e.g., unopened fried rice and noodle soup packages that were left in the kitchen).
○ **Partly used foods**: rice and noodle that is disposed of after it has been party used (e.g., half a package of fried rice eaten, and half a pot of rice eaten that were left in the kitchen).
○ **Meal leftovers**: leftovers that are disposed of after these were left on the plate, or bowl (e.g., rice that was left on the plate with breakfast, and noodle that was left on the soup bowl with lunch and dinner).
○ **Leftovers after storing meals**: leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., a frozen fried rice portion from last week).

8. In your household, did you dispose of vegetables and Fruit including their products as well as every part of vegetables and fruits yesterday?

○ Yes, I did. (*Please continue to answer question number 9 and 10*)
○ No, I didn't. (*Please skip to answer question number 11*)

9. In your household, how much vegetables and fruit were disposed of yesterday?
(*One normal serving small plate equals approximately 150 grams.*)

○ Less than one serving small plate ○ 1 to 2 serving small plates
○ 3 to 4 serving small plates ○ 5 to 6 serving small plates
○ More than 6 serving small plates

10. In your household, to which category did the **majority** of the disposed of vegetables and fruit belong?

○ **Completely unused foods**: vegetables and fruit that are disposed of which have not been used at all (e.g., unopened vegetable and fruit packages, complete fruit, and dried complete vegetable that was left in the kitchen).
○ **Partly used foods**: vegetables and fruit that are disposed of after it has been party used (e.g., vegetable stalks, and fruit seeds that were left in the kitchen).

○ **Meal leftovers**: leftovers that are disposed of after these were left on the plate, pots, or pans (e.g., the cooked vegetables that were left on the plate or in the pan).
○ **Leftovers after storing meal:** leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., the refrigerated vegetable and fruit portion of last week).

11. In your household, did you dispose of meat including their products (e.g., meatball, fish ball, and sausage) as well as every part of the meat (e.g., chicken bone, fishbone, and fish head) yesterday?

○ Yes, I did. (*Please continue to answer question number 12 and 13*)
○ No, I didn't. (*Please skip to answer question number 14*)

12. In your household, how much meat was disposed of yesterday?
(*One normal serving small plate equals approximately 200 grams.*)

○ Less than one serving small plate ○ 1 to 2 serving small plates
○ 3 to 4 serving small plates ○ 5 to 6 serving small plates
○ More than 6 serving small plates

13. In your household, to which category did the **majority** of the disposed of meat belong?

○ **Completely unused foods**: meat that is disposed of which has not been used at all (e.g., unopened meat packages, and fresh whole fish that were left in the kitchen).
○**Partly used foods**: meat that is disposed of after it has been party used (e.g., chicken and fish bones, and fish heads that were left in the kitchen).
○ **Meal leftovers**: leftovers that are disposed of after these were left on the plate, or in the bowls (e.g., fish bones that were left on the plate with the breakfast and fish balls that were left in the noodle soup bowl with the lunch).
○ **Leftovers after storing meals**: leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., the refrigerated fried chicken portion of last week, and a refrigerated sausage portion of last month).

14. In your household, did you dispose of eggs including eggshells (e.g., omelets, sunny-side-up eggs, and boiled eggs)

○ Yes, I did. (*Please continue to answer question number 15 and 16*)

○ No, I didn't. (*Please skip to answer question number 17*)

15. In your household, how many eggs were disposed of yesterday?
(*One normal serving small plate equals approximately 150 grams.*)

○ Less than one serving small plate ○ 1 to 2 serving small plates

○ 3 to 4 serving small plates ○ 5 to 6 serving small plates

○ More than 6 serving small plates

16. In your household, to which category did the **majority** of the disposed of eggs including eggshells belong?

○ **Completely unused foods**: eggs that are disposed of which have not been used at all (e.g., unopened egg packages that were left in the kitchen).

○ **Partly used foods**: eggs that are disposed of after it has been party used (e.g., eggshell).

○ **Meal leftovers**: leftovers that are disposed of after these were left on the plate, or pans (e.g., an omelet that was left on the plate with the breakfast).

○ **Leftovers after storing meals:** leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., the refrigerated omelet portion over the past three days).

17. In your household, did you dispose of seasoning (e.g., shrimp paste, fish sauces, tomato sauces, sugar packs, and cream powder packs) yesterday?

○ Yes, I did. (*Please continue to answer question number 18 and 19*)

○ No, I didn't. (*Please skip to answer question number 20*)

18. In your household, how much seasoning was disposed of yesterday?
(*One normal serving tablespoon equals approximately 15 grams.*)

(*One normal serving glass equals approximately 150 cc. or grams.*)
(*One normal serving bottle equals approximately 500 cc. or grams.*)

○ Less than 1 serving tablespoon
○ 1 to 2 serving tablespoons
○ 3 to 4 serving tablespoons
○ 5 to 6 serving tablespoons
○ 1 normal serving glass
○ 2 normal serving glasses
○ 1 normal serving bottle
○ 2 to 3 normal serving bottles
○ More than 3 normal serving bottles

19. In your household, to which category did the **majority** of the disposed of seasoning belong?

○ **Completely unused foods**: seasoning that is disposed of which has not been used at all (e.g., an unopened soy sauce and unopened sugar packs were left in the kitchen).
○ **Partly used foods**: seasoning that is disposed of after it has been party used (e.g., half a bottle of soybean sauce or fish sauce was left in the kitchen).
○ **Meal leftovers**: leftovers that are disposed of after these were left in the cups or packs (e.g., soybean sauce that was left in the cup with the breakfast, as well as sugar, and cream powder that were left in the pack with the breakfast, and chili paste that was left in the cup with the dinner).
○ **Leftovers after storing meals** leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., the refrigerated ketchup single serve packets of three months).

20. In your household, did you dispose of soup and curry yesterday?

○ Yes, I did. (*Please continue to answer question number 21 and 22*)
○ No, I didn't. (*Please skip to answer question number 23*)

21. In your household, how much soup and curry were disposed of yesterday?
(*One normal serving tablespoon equals approximately 15 grams.*)
(*One normal serving glass equals approximately 150 cc. or grams.*)

(*One normal serving bottle equals approximately 500 cc. or grams.*)

○ Less than 1 serving tablespoon
○ 1 to 2 serving tablespoons
○ 3 to 4 serving tablespoons
○ 5 to 6 serving tablespoons
○ 1 normal serving glass
○ 2 normal serving glasses
○ 1 normal serving bottle
○ 2 to 3 normal serving bottles
○ More than 3 normal serving bottles

22. In your household, to which category did the **majority** of the disposed of soup and curry belong?

○ **Completely unused foods**: soup and curry that are disposed of which have not been used at all (e.g., unopened soup and curry packages that were left in the kitchen).

○ **Partly used foods**: soup and curry that are disposed of after it has been party used (e.g., half a package of chicken curry soup, and half a pot of chicken spicy soup eaten that were left in the kitchen).

○ **Meal leftovers**: leftovers that are disposed of after these were left in the bowl, or pots (e.g., chicken spicy soup that was left in the bowl with the breakfast, and beef curry that was left in the pot with the dinner).

○ **Leftovers after storing meals**: leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., the refrigerated chicken curry soup of last week).

23. In your household, did you dispose of dairy products (e.g., UHT milk, soy milk, and yogurt) yesterday?

○ Yes, I did. (*Please continue to answer question number 24 and 25*)
○ No, I didn't. (*Please skip to answer question number 26*)

24. In your household, how many dairy products were disposed of yesterday? (e.g., yogurt, cheese, and butter)
(*One normal serving tablespoon equals approximately 15 grams.*)

(*One normal serving glass equals approximately 150 cc. or grams.*)
(*One normal serving bottle equals approximately 500 cc. or grams.*)

○ Less than 1 serving tablespoon
○ 1 to 2 serving tablespoons
○ 3 to 4 serving tablespoons
○ 5 to 6 serving tablespoons
○ 1 normal serving glass
○ 2 normal serving glasses
○ 1 normal serving bottle
○ 2 to 3 normal serving bottles
○ More than 3 normal serving bottles

25. In your household, to which category did the **majority** of the disposed of dairy products belong?

○ **Completely unused foods**: dairy products that are disposed of which has not been used at all (e.g., unopened UHT milk boxes were left in the kitchen).
○ **Partly used foods**: dairy products that are disposed of after it has been party used (e.g., half a bottle of soy milk was left in the kitchen).
○ **Meal leftovers**: leftovers that are disposed of after these were left in the cups or glasses (e.g., milk, soy milk, and yogurt that were left in the cup with the breakfast).
○ **Leftovers after storing meals:** leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., the refrigerated almond milk of last week).

26. In your household, did you dispose of drinks and beverages yesterday?

○ Yes, I did. (*Please continue to answer question number 27 and 28*)
○ No, I didn't. (*Please skip to answer question number 29*)

27. In your household, how many drinks and beverages were disposed of yesterday?
(*One normal serving tablespoon equals approximately 15 grams.*)
(*One normal serving glass equals approximately 150 cc. or grams.*)
(*One normal serving bottle equals approximately 500 cc. or grams.*)

○ Less than 1 serving tablespoon ○ 1 to 2 serving tablespoons

○ 3 to 4 serving tablespoons ○ 5 to 6 serving tablespoons

○ 1 normal serving glass ○ 2 normal serving glasses

○ 1 normal serving bottle

○ 2 to 3 normal serving bottles

○ More than 3 normal serving bottles

28. In your household, to which category did the **majority** of the disposed of drinks and beverages belong?

○ **Completely unused foods**: drinks and beverage that is disposed of which have not been used at all (e.g., unopened orange juice boxes were left in the kitchen).

○ **Partly used foods**: drinks and beverage that is disposed of after it has been party used (e.g., half a bottle of juice was left in the kitchen).

○ **Meal leftovers**: leftovers that are disposed of after these were left in the cups or glasses (e.g., coffee, and tea that were left in the cup with the breakfast, and orange juice or Coca-Cola that was left in the glasses with the lunch).

○ **Leftovers after storing meals:** leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., the refrigerated fresh juice bottle of two last week).

29. In your household, did you dispose of oil yesterday?

○ Yes, I did. (*Please continue to answer question number 30 and 31*)

○ No, I didn't. (*Please skip to answer question number 32*)

30. In your household, how much oil was disposed of yesterday?
(*One normal serving tablespoon equals approximately 15 grams.*)
(*One normal serving bottle equals approximately 500 cc. or grams.*)

○ Less than 1 serving tablespoon ○ 1 to 2 serving tablespoons

○ 3 to 4 serving tablespoons ○ 5 to 6 serving tablespoons

○ 1 normal serving glass ○ 2 normal serving glasses

○ 1 normal serving bottle

○ 2 to 3 normal serving bottles

○ More than 3 normal serving bottles

31. In your household, to which category did the **majority** of the disposed of oils belong?

○ **Completely unused foods**: oils that are disposed of which have not been used at all (e.g., an unopened soybean oil bottle was left in the kitchen).

○ **Partly used foods**: oils that are disposed of after it has been party used (e.g., half a bottle of rice bran oil was left in the kitchen).

○ **Meal leftovers**: leftovers that are disposed of after these were left in the pans (e.g., the used rice bran oil was left in the pans after cooking deep-fried chicken with the lunch).

○ **Leftovers after storing meals**: leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., half a pot of the used rice bran oil of the two last week is stored in the fridge).

32. In your household, did you dispose of cereal and bread yesterday?

○ Yes, I did. (*Please continue to answer question number 33 and 34*)

○ No, I didn't. (*Please skip to answer question number 35*)

33. In your household, how much cereal and bread were disposed of yesterday?
(*One normal serving small plate equals approximately 150 grams.*)

○ Less than one serving small plate ○ 1 to 2 serving small plates

○ 3 to 4 serving small plates ○ 5 to 6 serving small plates

○ More than 6 serving small plates

34. In your household, to which category did the **majority** of the disposed of cereal and bread belong?

○ **Completely unused foods**: cereal and bread that are disposed of which have not been used at all (e.g., unopened bread packages and cereal boxes were left in the kitchen).

○ **Partly used foods**: cereal and bread that are disposed of after it has been party used (e.g., half a pack of bread was left in the kitchen).

○ **Meal leftovers**: leftovers that are disposed of after these were left on the plate and in the cups (e.g., the toast was left on the plate, and the cereals were left in the cup with milk).

○ **Leftovers after storing meals**: leftovers that are disposed of after these were stored in the fridge or freezer to be eaten at a later moment (e.g., three refrigerated toasts of the last week).

35. What do you think are **the main reasons** that food gets wasted in your household?

What are the main reasons that food gets wasted in your household (Personal Habits)	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
Food safety (routines in the preparation, handling, and storage of food intended to prevent foodborne illness and injury)	○	○	○	○	○
Inconvenience	○	○	○	○	○
Taste dissatisfaction	○	○	○	○	○
Not eating what needs eating first	○	○	○	○	○
High frequency of buying food	○	○	○	○	○
Lack of cooking skills	○	○	○	○	○
Lack of storage knowledge	○	○	○	○	○
Preparing/Cooking too much at one time	○	○	○	○	○

What are the main reasons that food gets wasted in your household (Personal Habits)	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
Errors in serving and storing food	○	○	○	○	○
Lack of skills to process leftovers into new food	○	○	○	○	○
Throwing leftover food is common for the household members	○	○	○	○	○
Confusion between “Best Before Date” and “Use by date”	○	○	○	○	○

What are the main reasons that food gets wasted in your household (Shopping Habits)	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
Buying food in large quantity	○	○	○	○	○
Buying products that are not needed	○	○	○	○	○
Buying too many perishables	○	○	○	○	○
Lack of planning when shopping	○	○	○	○	○
Impulse purchases are usually due to special offers from sellers	○	○	○	○	○
Spontaneous purchases because you are interested in the product while in the store	○	○	○	○	○

What are the main reasons that food gets wasted in your household (Product Characteristics)	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
Too large product packaging (not finished in one consumption)	○	○	○	○	○
Fresh products with shorter shelf life	○	○	○	○	○
Bad quality (easily damaged) packaging	○	○	○	○	○

What are the main reasons that food gets wasted in your household (Moral Attitude)	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I believe that throwing away food is a mistake.	○	○	○	○	○
I believe that throwing away food should not be done.	○	○	○	○	○
I have feelings of shame when disposing food waste.	○	○	○	○	○
I feel guilty when disposing food waste.	○	○	○	○	○
I desire to be an excellent example for families with an attitude of appreciating food.	○	○	○	○	○

Part III. Food consumption management

- Management carried out by households starts from planning, providing food, preparation, serving/processing, storage, and food waste disposal/usage **(For someone who is in charge of planning the food menu for family members (housewive or husbands)**.

Planning	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I make menu plans for a certain period (e.g., daily plan, weekly plan).	○	○	○	○	○
I will check the stock in the refrigerator before making the shopping list.	○	○	○	○	○
I will make a shopping list according to my needs.	○	○	○	○	○
I combine the number of items to be purchased to avoid overspending.	○	○	○	○	○
I make a shopping list and consistently follow the list when shopping.	○	○	○	○	○
I have adequate (decent) storage space so that the food I store lasts longer.	○	○	○	○	○
I will shop according to the capacity of my food storage (e.g., refrigerator or other storage space).	○	○	○	○	○
To reduce leftovers, I plan to buy less food.	○	○	○	○	○
I will adjust the quantity of cooked food according to the number of family members present.	○	○	○	○	○

Provision	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I will cook the ingredients available in the refrigerator before buying more.	○	○	○	○	○
I buy groceries/cooked food at a mobile vegetable vendor/food truck.	○	○	○	○	○
I buy groceries/cooked food at the shop.	○	○	○	○	○
I buy groceries/cooked food at the traditional market.	○	○	○	○	○
I buy groceries/cooked food at the mini market.	○	○	○	○	○
I buy groceries/cooked food at the supermarket.	○	○	○	○	○
I buy groceries/cooked food online.	○	○	○	○	○

Preparation	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
In the food preparation process, I usually use existing ingredients.	○	○	○	○	○
I am used to cooking for the amount my family needs.	○	○	○	○	○
If there are guests, I will provide enough food that they need. (I have	○	○	○	○	○

Preparation	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
never followed the principle of "it's better to have leftovers than serving less food").					
I don't throw away fruits or vegetables with holes or not smooth.	○	○	○	○	○

Serving/Processing	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
If there are leftovers, our family usually eats them either in the same form or reheated.	○	○	○	○	○
Before being eaten again, the leftover food will be processed into new food by adding other ingredients.	○	○	○	○	○
I feel comfortable when processing leftovers.	○	○	○	○	○
I feel comfortable when I eat decent leftovers.	○	○	○	○	○
If I have leftover rice, I will process it into fried rice or other forms of food.	○	○	○	○	○

Serving/Processing	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
If I have fruit that is too ripe, I will process it into jam or other processed products.	○	○	○	○	○
I can adjust my cooking plan by taking into account the leftovers I have at home.	○	○	○	○	○
My kids love home food, so the food I cook is rarely left.	○	○	○	○	○
I don't buy food from outside if the food at home has not been consumed.	○	○	○	○	○
When I already cook, other family members eat at home	○	○	○	○	○
I can eat the same food consecutively in one day.	○	○	○	○	○
I understand that eating leftovers that are still decent doesn't have bad effects on health.	○	○	○	○	○
I rarely forget to keep leftovers in the refrigerator until they go stale.	○	○	○	○	○

Storage	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I label food purchase dates for food that doesn't have expiration date.	○	○	○	○	○

Storage	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
I label the expiration date of the food I keep in the refrigerator.	○	○	○	○	○
I arrange food by expiration date.	○	○	○	○	○
I check/know when the food is nearing the expiration date.	○	○	○	○	○
I eat food before its quality decreases (e.g., Before vegetables wilt, before tempeh turns yellow etc.).	○	○	○	○	○
I keep leftovers in the fridge to use again and they are rarely forgotten because I consume them later.	○	○	○	○	○
The food that I keep in the refrigerator is rarely forgotten even though the refrigerator is messy and full.	○	○	○	○	○

Food Waste Disposal/Utilization	**Strongly disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly agree (5)**
If I have excess food (bought/given) I will share it with neighbors/friends/relatives.	○	○	○	○	○
If I cook too much, I will share the food with neighbors/friends/relatives.	○	○	○	○	○

Food Waste Disposal/Utilization	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I will give leftovers to other people if they are intact and decent.	○	○	○	○	○
I will use the food leftovers to feed pets/livestock.	○	○	○	○	○
I accidentally cook more so that the rest can be given to the pets.	○	○	○	○	○
I will process the leftovers into compost/liquid fertilizer.	○	○	○	○	○

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Appendix B. Certificate of Research Ethics Committee Approval

MF-04-version-2.0
วันที่ 18 ก.ค. 61

Certificate of Ethical Committee Approval

Protocol code SWUEC- 256/2022E

The study protocol and related documents shown below has been reviewed by the Human Research Ethics Committee, Srinakarinwirot University. The committee agreed that the study protocol comply with the international guidelines for human research, along with the laws and regulations of Thailand. Thus, the approval for conducting the study is granted.

Title of Protocol	: Household Food Waste Management during COVID-19 Pandemic in Thailand and Indonesia: A Case Study of Undergraduate Students.	
Principal Investigator	: Associate Professor Dr.Jirawat Jaroensathapornkul	
Institution	: Faculty of Economic	
The approved documents:	1. Submission Form	version 2.0/ date 16/09/2022
	2. Protocol	version 2.0/ date 16/09/2022
	3. Participant Information Sheet	version 2.0/ date 16/09/2022
	4. Informed Consent Form	version 2.0/ date 16/09/2022

(Assistant Professor Dr. Napapa Aimjirakul D.D.S, Ph.D.)
Secretary of the Human Research Ethics Committee of Srinakharinwirot University

(Dr. Sureeporn Patrasuwan M.D.)
Chairman of the Human Research Ethics Committee of Srinakharinwirot University

Approval code : SWUEC/E-256/2022
Approval date: 16/09/2022

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RESEARCH ETHICS COMMITTEE APPROVAL

No: KE/UGM/043/EC/2022

Title of the Research Protocol	:	Household Food Waste Management during COVID-19 Pandemic in Thailand and Indonesia: A Case Study of Undergraduate Students
Document(s) Approved and Version	:	Study Protocol version 02 2022 Information Sheet for Participants version 02 2022 Informed Consent Form version 01 2021
Principle Investigator	:	Jirawat Jaroensathapornkul, Ph.D.
Participating Investigator(s)	:	1. Dr. Jangkung Handoyo Mulyo, M.Ec. 2. Dr. Hani Perwitasari, S.P., M.Sc. 3. Supitcha Chotikhamjorn, M.Econ. 4. Imelda, S.P., M.Sc.
Date of Approval	:	31 Oktober 2022 (valid for one year beginning from the date of approval)
Institution(s)/location of research	:	Indonesia and Thailand

Research Ethics Committee Universitas Gadjah Mada states that the above documents meet the ethical principles on ethical standards and procedures for research involving human participants.

Research Ethics Committee Universitas Gadjah Mada has the right to monitor the research activities at any time.

The investigators (s) is/are obliged to submit:

- ☐ Progress reports as a continuing review
- ☐ Report of any serious adverse events (SAE)
- ☒ Final report upon the completion of the study.

This approval letter can't replace a research permit in Indonesia for foreign researchers. It must be submitted in accordance with the goverment's applicable provisions and regulations.

Panel's Chairperson	Panel's Secretary
Prof. Dr. Ir. Rini Widiati, M.S.	Dr. Silvi Nur Oktalina, S.Hut., M.Si.

Appendix C. Validity and Reliability Tests

Variable/Indicator	Validity Test	
	Sig Validity Test	Category
Food waste reducing consequences		
I believe that reducing household food waste is an effective approach to minimize pollution (FWC1)	0.00	valid
I believe that reducing household food waste contributes to a healthier environment for the next generation (e.g., a pile of food waste will cause air pollution (nitrogen and methane gas) which has a bad impact on newborns around landfills) (FWC2)	0.00	valid
I believe that reducing household food waste is a critical component of reducing landfill waste (FWC3)	0.00	valid
Practical Benefits of Food Waste		
I have enough time to worry about the amount of food wasted (PBFW1)	0.00	valid
Leftover food should be checked to make sure that the food is still edible (e.g., leftover rice needs to be checked whether it is edible or not) (PBFW2)	0.00	valid
Throwing away food if the package expiry date has passed reduces the chances someone will get sick from eating the food (PBFW3)	0.00	valid
Health awareness		
I believe that eating expired food will increase the possibility of being sick (e.g., consuming expired bread will cause a stomachache) (HA1)	0.00	valid
I'm worried that eating recooked leftovers (e.g., recooking leftover rice into fried rice) can damage my health (HA2)	0.00	valid
In my opinion, eating leftovers is harmful (HA3)	0.00	valid
Economic awareness		
I know that food waste causes economic problems (e.g., food waste in large quantity will require a higher cost to manage) (EW1)	0.00	valid
Throwing away food is a major source of waste money (EW2)	0.00	valid
I can save money by reducing food waste (e.g., buying food as needed will reduce food waste and save money) (EW3)	0.00	valid
Overconsumption contributes to high prices of food (EW4)	0.00	valid
I can help control the prices of food by avoiding wastage (EW5)	0.00	valid
Overconsumption increases the prices of goods (EW6)	0.00	valid
Social awareness		
I try to remind my friends, family, and people around me about the need to reduce food waste (SA1)	0.00	valid
I think everyone should share the responsibility to reduce food waste (SA2)	0.00	valid
People who are important to me (parents, friends, girl/boyfriend) consider my efforts to reduce the amount of food wasted (SA3)	0.00	valid
When I try to reduce the leftover food, people who are important to me (parents, friends, girl/boyfriend) tend to follow my eating habit (SA4)	0.00	valid
Cultural awareness		
I don't mind if my guests eat all the food, I have prepared for them (CA1)	0.00	valid
I rarely buy lots of fresh products to eat (CA2)	0.00	valid
Food Waste Guilt		
I feel guilty for throwing away food (FWG1)	0.00	valid

Variable/Indicator	Validity Test	
	Sig Validity Test	Category
I feel guilty for generating food waste while many people do not have guaranteed access to edible food (FWG2)	0.00	valid
I feel guilty for generating food waste because it has negative effects on the environment, economy, and society (FWG3)	0.00	valid
Environmental awareness		
I have knowledge about the purchase of environmentally friendly products (organic rice, organic vegetables, and organic fruits) (EA1)	0.03	valid
I have knowledge about food waste recycling (composting food waste) and reusing leftover food (recooking leftover rice into fried rice) (EA2)	0.03	valid
I have knowledge of the purchase of waste-reduction packaging (EA3)	0.00	valid
I have knowledge of environmental labeling (e.g., organic ingredient labels, and eco-friendly labels) (EA4)	0.00	valid
I have knowledge about a variety of environmental issues (e.g., food waste represents a great waste of freshwater and groundwater resources) (EA5)	0.00	valid
Reducing food waste can reduce environmental hazards because it can save the land, water, and energy that would have been used to make it (EA6)	0.00	valid
Food waste causes environmental pollution because food waste produces a large amount of methane, which is more dangerous than CO_2 (EA7)	0.00	valid
Potentials for Food Waste Reduction		
My household food waste is equal to other households of my size (FWRP1)	0.00	valid
It would be easy to reduce food waste further (FWRP2)	0.00	valid
I tend to throw away less leftover food when I buy food in large quantity (e.g., buying vegetables in large quantity will tend to produce leftovers which are then thrown away) (FWRP3)	0.00	valid
I plan to reduce household food waste by learning more about the negative impacts of food waste (e.g., increasing air pollution and wasting money) (FWRP4)	0.00	valid

Code	Variable	Reliability Test	
		Sig Reliability Test	Category
TFWC	Food waste consequences	0.82	Very high
TPBFW	Practical Benefits of Food Waste	0.20	Very low
THA	Health awareness	0.32	Low
TEW	Economic awareness	0.76	High
TSA	Social awareness	0.32	Low
TCA	Culture awareness	0.32	Low
TFWG	Food Waste Guilt	0.85	Very high
TEA	Environmental awareness	0.84	Very high
TFWRP	Potentials for Food Waste Reduction	0.43	Intermediate

Variable/Indicator	Validity Test	
	Sig Validity Test	Category
Personal habit		
Food safety (routines in the preparation, handling, and storage of food intended to prevent foodborne illness and injury) (PH1)	0.00	valid
Inconvenience (PH2)	0.00	valid
Taste dissatisfaction (PH3)	0.00	valid
Not eating what needs eating first (PH4)	0.00	valid
High frequency of buying food (PH5)	0.00	valid
Lack of cooking skills (PH6)	0.00	valid
Lack of storage knowledge (PH7)	0.00	valid
Preparing/Cooking too much at one time (PH8)	0.00	valid
Errors in serving and storing food (PH9)	0.00	valid
Lack of skills to process leftovers into new food (PH10)	0.00	valid
Throwing leftover food is common for the household members (PH11)	0.00	valid
Confusion between “Best Before Date” and “Use by date” (PH12)	0.00	valid
Shopping habits		
Buying food in large quantity (SH1)	0.00	valid
Buying products that are not needed (SH2)	0.00	valid
Buying too many perishables (SH3)	0.00	valid
Lack of planning when shopping (SH4)	0.00	valid
Impulse purchases are usually due to special offers from sellers (SH5)	0.00	valid
Spontaneous purchases because you are interested in the product while in the store (SH6)	0.00	valid
Product characteristics		
Too large product packaging (not finished in one consumption) (PC1)	0.00	valid
Fresh products with shorter shelf life (PC2)	0.00	valid
Bad quality (easily damaged) packaging (PC3)	0.00	valid
Moral Attitude		
I believe that throwing away food is a mistake (MA1)	0.00	valid
I believe that throwing away food should not be done (MA2)	0.00	valid
I have feelings of shame when disposing food waste (MA3)	0.00	valid
I feel guilty when disposing food waste (MA4)	0.00	valid
I desire to be an excellent example for families with an attitude of appreciating food (MA50)	0.00	valid
Planning		
I make menu plans for a certain period (e.g., daily plan, weekly plan) (PL1)	0.00	valid
I will check the stock in the refrigerator before making the shopping list (PL2)	0.00	valid
I will make a shopping list according to my needs (PL3)	0.00	valid
I combine the number of items to be purchased to avoid overspending I make a shopping list and consistently follow the list when shopping (PL4)	0.00	valid
I make a shopping list and consistently follow the list when shopping (PL5)	0.00	valid

Variable/Indicator	Validity Test	
	Sig Validity Test	Category
I have adequate (decent) storage space so that the food I store lasts longer (PL6)	0.00	valid
I will shop according to the capacity of my food storage (e.g., refrigerator or other storage space) (PL7)	0.00	valid
To reduce leftovers, I plan to buy less food (PL8)	0.00	valid
I will adjust the quantity of cooked food according to the number of family members present (PL9)	0.00	valid
Provision		
I will cook the ingredients available in the refrigerator before buying more (PF1)	0.00	valid
I buy groceries/cooked food at a mobile vegetable vendor/food truck (PF2)	0.00	valid
I buy groceries/cooked food at the shop (PF3)	0.00	valid
I buy groceries/cooked food at the traditional market (PF4)	0.00	valid
I buy groceries/cooked food at the mini market (PF5)	0.00	valid
I buy groceries/cooked food at the supermarket (PF6)	0.00	valid
I buy groceries/cooked food online (PF7)	0.00	valid
Preparation		
In the food preparation process, I usually use existing ingredients (PR1)	0.00	valid
I am used to cooking for the amount my family needs (PR2)	0.00	valid
If there are guests, I will provide enough food that they need. (I have never followed the principle of “it’s better to have leftovers than serving less food”) (PR3)	0.00	valid
I don’t throw away fruits or vegetables with holes or not smooth (PR4)	0.00	valid
Serving/Processing		
If there are leftovers, our family usually eats them either in the same form or reheated (S1)	0.00	valid
Before re-consumed, the leftover food will be processed into new food by adding other ingredients (S2)	0.00	valid
I feel comfortable when processing leftovers (S3)	0.00	valid
I feel comfortable when I eat decent leftovers (S4)	0.00	valid
If I have leftover rice, I will process it into fried rice or other forms of food (S5)	0.00	valid
If I have fruit that is too ripe, I will process it into jam or other processed products (S6)	0.00	valid
I can adjust my cooking plan by taking into account the leftovers I have at home (S7)	0.00	valid
My kids love home food so the food I cook is rarely left (S8)	0.00	valid
I don't buy food from outside if the food at home has not been consumed (S9)	0.00	valid
When I already cook, other family members eat at home (S10)	0.00	valid
I can eat the same food consecutively in one day (S11)	0.00	valid
I understand that eating leftovers that are still decent doesn't have bad effects on health (S12)	0.00	valid
I rarely forget to keep leftovers in the refrigerator until they go stale (S13)	0.00	valid

Variable/Indicator	Validity Test	
	Sig Validity Test	Category
Storage		
I label food purchase dates for food that doesn't have expiration date (ST1)	0.00	valid
I label the expiration date of the food I keep in the refrigerator (ST2)	0.00	valid
I arrange food by expiration date (ST3)	0.00	valid
I check/know when the food is nearing the expiration date (ST4)	0.00	valid
I eat food before its quality decreases (e.g., Before vegetables wilt, before tempeh turns yellow etc.) (ST5)	0.00	valid
I keep leftovers in the fridge to use again and they are rarely forgotten because I consume them later (ST6)	0.00	valid
The food that I keep in the refrigerator is rarely forgotten even though the refrigerator is messy and full (ST7)	0.00	valid
Food Waste Disposal/Utilization		
If I have excess food (bought/given) I will share it with neighbors/friends/relatives (U1)	0.00	valid
If I cook too much, I will share the food with neighbors/friends/relatives (U2)	0.00	valid
I will give leftovers to other people if they are intact and decent (U3)	0.00	valid
I will use the food leftovers to feed pets/livestock (U4)	0.00	valid
I accidentally cook more so that the rest can be given to the pets (U5)	0.10	valid
I will process the leftovers into compost/liquid fertilizer (U6)	0.00	valid

Code	Variable	Reliability Test	
		Sig reliability test	Category
TPH	Personal habit	0.79	High
TSH	Shopping habits	0.87	Very high
TPC	Product characteristics	0.72	High
TMA	Moral Attitude	0.86	Very high
TPL	Planning	0.85	Very high
TPF	Provision	0.61	High
TPR	Preparation	0.70	High
TS	Serving/Processing	0.75	High
TST	Storage	0.63	High
TU	Food Waste Disposal/Utilization	0.10	Very low

Appendix D. Guide for Focus Group Discussion/In-Depth Interviews

"Household Food Waste Management during COVID-19 Pandemic in Thailand and Indonesia: A Case Study of Undergraduate Students"

Participants

(i) The focus group discussion (FGD)/In-Depth Interviews participants were derived from a sample of respondents. The research team makes an announcement for FGD participants' applications and then the selection system is on a first come first serve basis.

(ii) The FGD/In-Depth Interviews participants were people with the following details:

- 10 SWU participants (Students together with the head of household who is mainly in charge of food consumption at home or the wife of the head of household and the student).
- 15 UGM participants (Students together with the head of household who is mainly in charge of food consumption at home or the wife of the head of household and the student).

Time

(i) The FGD/In-Depth Interviews is planned for January to February 2023 and will be carried out through a Zoom or Line Application
meeting application.

(ii) The FGD/In-Depth Interviews is carried out separately between the SWU and UGM students and their parents.

(iii) The duration of the FGDs / In-Depth Interviews is 30 - 90 minutes each.

Discussion Guidelines

(i) The implementation of the FGD/In-Depth Interviews begins with an explanation of the aims and objectives of the FGD as well as the topics and main contents of the discussion.

(ii) The questions used in the FGD/In-Depth Interviews session were more specific but they did not depart from the main objectives of the research, namely:

- To know SWU and UGM undergraduate students' awareness of food waste issues.
- To know the household food waste of SWU and UGM undergraduate students.

- To analyze the factors causing household food waste of SWU and UGM undergraduate students.
- To know how households of SWU and UGM undergraduate students manage their food waste.

(iii) Some of the guide questions during the FGD/In-Depth Interviews are detailed as follows:

- What do you think about the impact of food waste on the health sector?
- What do you think about the impact of food waste on the economy?
- What do you think about the impact of food waste on the social sector?
- What do you think about the impact of food waste on culture?
- What do you think about the impact of food waste on the environment?
- Do you feel any practical benefits from food waste behavior?
- Do you feel guilty about food waste behavior?
- What do you think about the potential for reducing food waste in your household?
- From the following food categories: rice and noodles, vegetables and fruits, meat, eggs, seasoning, soup, milk and yogurt, drink, oil, cereals, and bread. Name the three types of food that were wasted the most in the last 24 hours, and what was the reason for throwing them away.
- What are your household habits when you eat food?
- What are your household habits when shopping for food?
- How is the food menu planned in your household?
- How is food prepared in your household?
- How is food served in your household?
- How is food stored in your household?
- If there is food that is not consumed, what will your household do?
- Do you have any ideas on reducing food waste in your household?
- In your opinion, what policies support and do not support food waste management?

(iv) The FGD/In-Depth Interviews guide can add question points beyond the above guidelines if necessary.

(v) Questions should be given starting from the general to the specific.

(vi) The nature of the questions is unstructured and open-ended, allowing participants to answer with various dimensions according to the facts they find.

(vii) Carry out FGD/In-Depth Interviews as best as possible within the specified time.

(viii) Speak well, politely, clearly, and easily understood during the FGD.

(ix) Observing and understanding answers from FGD/In-Depth Interviews participants. If necessary, provide follow-up questions if there are things that are not understood.

(x) Record and make a transcript of the implementation of the discussion as well and as completely as possible for interpreting the data.

FGD / In-Depth Interviews data analysis

(i) Analysis of discussion content of all FGD / In-Depth Interviews participants.

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Appendix E. Estimation Results of Tobit Models from Software

SWU

Dependent Variable: FWASTE_RICE
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:34
Sample: 1 394
Included observations: 383
Left censoring (value) at zero
Convergence achieved after 6 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	186.1557	77.01451	2.417151	0.0156
AGE	-1.894611	1.145624	-1.653781	0.0982
INCOME	-0.000124	0.000123	-1.001290	0.3167
EXPEND	0.000288	0.000676	0.425844	0.6702
FAMMEMBER	-1.960663	5.971079	-0.328360	0.7426
CHILD	-1.223410	8.581315	-0.142567	0.8866
ELDER	3.962955	9.141509	0.433512	0.6646
EDU	0.928527	1.856850	0.500055	0.6170
GENDER_D1	-51.44836	14.94731	-3.441982	0.0006
AREA_D1	-2.385335	14.03747	-0.169926	0.8651
STATUS_D1	-15.08599	18.34962	-0.822142	0.4110
PERSHABIT	-3.352861	1.470809	-2.279603	0.0226
SHOPHABIT	1.853937	2.759059	0.671945	0.5016
PRODCHARAC	-4.756378	4.516027	-1.053222	0.2922
ATTITUDE	-0.266021	1.949377	-0.136465	0.8915
Error Distribution				
SCALE:C(16)	111.0276	6.391818	17.37027	0.0000

Mean dependent var	34.46475	S.D. dependent var	67.01206
S.E. of regression	66.67995	Akaike info criterion	6.485116
Sum squared resid	1631761.	Schwarz criterion	6.650047
Log likelihood	-1225.900	Hannan-Quinn criter.	6.550541
Avg. log likelihood	-3.200782		

Left censored obs	203	Right censored obs	0
Uncensored obs	180	Total obs	383

Dependent Variable: FWASTE_VEGETABLES
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:36
Sample: 1 394
Included observations: 385
Left censoring (value) at zero
Convergence achieved after 8 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	111.8409	121.9240	0.917300	0.3590
AGE	-1.032763	1.823088	-0.566491	0.5711
INCOME	0.000471	0.000191	2.470611	0.0135
EXPEND	-0.001867	0.001168	-1.598786	0.1099
FAMMEMBER	-8.075345	9.373482	-0.861510	0.3890
CHILD	-1.860666	13.64489	-0.136364	0.8915
ELDER	-9.525133	15.27047	-0.623762	0.5328
EDU	-1.852757	2.989740	-0.619705	0.5355
GENDER_D1	-21.84607	24.49886	-0.891718	0.3725
AREA_D1	-39.34888	22.30612	-1.764039	0.0777
STATUS_D1	-47.84337	30.84843	-1.550918	0.1209
PERSHABIT	-1.957818	2.316069	-0.845319	0.3979
SHOPHABIT	1.450208	4.378238	0.331231	0.7405
PRODCHARAC	-3.883609	7.195561	-0.539723	0.5894
ATTITUDE	5.880530	3.130588	1.878411	0.0603
Error Distribution				
SCALE:C(16)	178.5197	10.72095	16.65148	0.0000

Mean dependent var	54.74026	S.D. dependent var	100.9651
S.E. of regression	100.5983	Akaike info criterion	6.575706
Sum squared resid	3734289.	Schwarz criterion	6.739997
Log likelihood	-1249.823	Hannan-Quinn criter.	6.640864
Avg. log likelihood	-3.246295		

Left censored obs	215	Right censored obs	0
Uncensored obs	170	Total obs	385

Dependent Variable: FWASTE_MEAT
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:37
Sample: 1 394
Included observations: 384
Left censoring (value) at zero
Convergence achieved after 7 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	177.4696	131.5627	1.348935	0.1774
AGE	-1.128588	1.947656	-0.579460	0.5623
INCOME	7.89E-05	0.000210	0.375065	0.7076
EXPEND	-1.49E-05	0.001175	-0.012650	0.9899
FAMMEMBER	9.956444	9.546516	1.042940	0.2970
CHILD	-9.933593	13.64280	-0.728120	0.4665
ELDER	5.621780	15.70247	0.358019	0.7203
EDU	-1.379483	3.180027	-0.433796	0.6644
GENDER_D1	-96.65409	25.87078	-3.736032	0.0002
AREA_D1	-5.754208	23.85691	-0.241197	0.8094
STATUS_D1	-48.53091	32.32756	-1.501224	0.1333
PERSHABIT	3.584723	2.446951	1.464975	0.1429
SHOPHABIT	-4.738579	4.700837	-1.008029	0.3134
PRODCHARAC	-7.860663	7.747620	-1.014591	0.3103
ATTITUDE	-3.793723	3.350336	-1.132341	0.2575
Error Distribution				
SCALE:C(16)	201.0993	10.15353	19.80586	0.0000

Mean dependent var	96.61458	S.D. dependent var	140.9183
S.E. of regression	139.5848	Akaike info criterion	8.661891
Sum squared resid	7170085.	Schwarz criterion	8.826501
Log likelihood	-1647.083	Hannan-Quinn criter.	8.727183
Avg. log likelihood	-4.289279		

Left censored obs	156	Right censored obs	0
Uncensored obs	228	Total obs	384

Dependent Variable: FWASTE_EGGS
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:38
Sample: 1 394
Included observations: 380
Left censoring (value) at zero
Convergence achieved after 7 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	235.9526	86.25879	2.735403	0.0062
AGE	-1.773535	1.264645	-1.402397	0.1608
INCOME	0.000173	0.000131	1.322822	0.1859
EXPEND	0.000458	0.000761	0.601860	0.5473
FAMMEMBER	-4.517099	6.440001	-0.701413	0.4830
CHILD	7.548503	8.888685	0.849226	0.3958
ELDER	10.49002	10.27589	1.020839	0.3073
EDU	-4.794102	2.059420	-2.327889	0.0199
GENDER_D1	-25.21542	17.10476	-1.474176	0.1404
AREA_D1	-20.21938	15.60322	-1.295846	0.1950
STATUS_D1	-40.82119	21.40569	-1.907025	0.0565
PERSHABIT	0.642578	1.600407	0.401509	0.6880
SHOPHABIT	1.155025	3.053452	0.378269	0.7052
PRODCHARAC	-13.04347	5.000062	-2.608661	0.0091
ATTITUDE	-1.268215	2.163683	-0.586137	0.5578
Error Distribution				
SCALE:C(16)	129.8464	6.990386	18.57499	0.0000

Mean dependent var	61.57895	S.D. dependent var	85.08963
S.E. of regression	83.60915	Akaike info criterion	7.611631
Sum squared resid	2544539.	Schwarz criterion	7.777533
Log likelihood	-1430.210	Hannan-Quinn criter.	7.677462
Avg. log likelihood	-3.763710		

Left censored obs	172	Right censored obs	0
Uncensored obs	208	Total obs	380

Dependent Variable: FWASTE_SEASONING
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:39
Sample: 1 394
Included observations: 385
Left censoring (value) at zero
Convergence achieved after 8 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	15.25119	53.21534	0.286594	0.7744
AGE	0.160093	0.776472	0.206180	0.8367
INCOME	-8.52E-05	8.72E-05	-0.978111	0.3280
EXPEND	0.000962	0.000441	2.180443	0.0292
FAMMEMBER	-7.658245	3.940610	-1.943416	0.0520
CHILD	-8.078882	5.806840	-1.391270	0.1641
ELDER	10.01397	5.925196	1.690066	0.0910
EDU	2.078208	1.311230	1.584930	0.1130
GENDER_D1	-8.877946	10.39110	-0.854380	0.3929
AREA_D1	-2.523706	9.509655	-0.265384	0.7907
STATUS_D1	-4.549744	12.50921	-0.363711	0.7161
PERSHABIT	-0.261285	1.035114	-0.252421	0.8007
SHOPHABIT	-0.394907	1.916751	-0.206029	0.8368
PRODCHARAC	-5.733540	3.218156	-1.781622	0.0748
ATTITUDE	-3.919252	1.401862	-2.795748	0.0052
Error Distribution				
SCALE:C(16)	67.06583	4.897443	13.69405	0.0000

Mean dependent var	8.974026	S.D. dependent var	31.23259
S.E. of regression	31.17719	Akaike info criterion	3.965137
Sum squared resid	358674.2	Schwarz criterion	4.129427
Log likelihood	-747.2888	Hannan-Quinn criter.	4.030295
Avg. log likelihood	-1.941010		

Left censored obs	272	Right censored obs	0
Uncensored obs	113	Total obs	385

Dependent Variable: FWASTE_SOUP
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:41
Sample: 1 394
Included observations: 383
Left censoring (value) at zero
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	116.5259	140.5552	0.829040	0.4071
AGE	-0.292485	2.064925	-0.141645	0.8874
INCOME	-0.000241	0.000227	-1.061013	0.2887
EXPEND	0.000268	0.001226	0.218555	0.8270
FAMMEMBER	3.809932	10.41894	0.365674	0.7146
CHILD	-8.981747	14.67423	-0.612076	0.5405
ELDER	-0.397105	16.77192	-0.023677	0.9811
EDU	-4.690961	3.400675	-1.379420	0.1678
GENDER_D1	24.75408	28.08211	0.881489	0.3781
AREA_D1	7.173666	25.44465	0.281932	0.7780
STATUS_D1	-18.70358	33.77137	-0.553829	0.5797
PERSHABIT	1.250062	2.635869	0.474250	0.6353
SHOPHABIT	-4.485276	4.996595	-0.897666	0.3694
PRODCHARAC	6.071981	8.147394	0.745267	0.4561
ATTITUDE	1.411692	3.583900	0.393898	0.6937
Error Distribution				
SCALE:C(16)	223.0111	9.495014	23.48718	0.0000

Mean dependent var	121.7363	S.D. dependent var	187.2797
S.E. of regression	190.4598	Akaike info criterion	11.01629
Sum squared resid	13312895	Schwarz criterion	11.18122
Log likelihood	-2093.620	Hannan-Quinn criter.	11.08172
Avg. log likelihood	-5.466370		

Left censored obs	87	Right censored obs	0
Uncensored obs	296	Total obs	383

Dependent Variable: FWASTE_DAIRY
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:41
Sample: 1 394
Included observations: 385
Left censoring (value) at zero
Convergence achieved after 10 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-847.1573	402.6214	-2.104104	0.0354
AGE	5.452446	5.882207	0.926939	0.3540
INCOME	-7.49E-05	0.000617	-0.121367	0.9034
EXPEND	-0.000532	0.003578	-0.148786	0.8817
FAMMEMBER	60.92962	29.10613	2.093361	0.0363
CHILD	-106.0753	54.99176	-1.928930	0.0537
ELDER	12.01782	45.31158	0.265226	0.7908
EDU	-5.714197	8.932379	-0.639717	0.5224
GENDER_D1	-72.29124	73.65330	-0.981507	0.3263
AREA_D1	119.6967	74.48095	1.607078	0.1080
STATUS_D1	9.512983	92.33852	0.103023	0.9179
PERSHABIT	-2.485713	7.501324	-0.331370	0.7404
SHOPHABIT	-9.649112	13.93463	-0.692455	0.4887
PRODCHARAC	-10.25864	23.25425	-0.441151	0.6591
ATTITUDE	5.888687	9.737480	0.604744	0.5453
Error Distribution				
SCALE:C(16)	373.8436	45.03970	8.300312	0.0000

Mean dependent var	13.38961	S.D. dependent var	100.9543
S.E. of regression	103.3802	Akaike info criterion	2.103258
Sum squared resid	3943673.	Schwarz criterion	2.267549
Log likelihood	-388.8772	Hannan-Quinn criter.	2.168417
Avg. log likelihood	-1.010071		

Left censored obs	342	Right censored obs	0
Uncensored obs	43	Total obs	385

Dependent Variable: FWASTE_DRINKS
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:42
Sample: 1 394
Included observations: 383
Left censoring (value) at zero
Convergence achieved after 9 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	41.63092	202.5711	0.205513	0.8372
AGE	1.782761	2.976907	0.598864	0.5493
INCOME	-0.000305	0.000330	-0.924209	0.3554
EXPEND	0.003112	0.001626	1.914073	0.0556
FAMMEMBER	-11.09556	16.39639	-0.676708	0.4986
CHILD	-14.95270	21.85475	-0.684186	0.4939
ELDER	35.02584	23.40417	1.496564	0.1345
EDU	1.331224	4.857875	0.274034	0.7841
GENDER_D1	-68.37794	39.33543	-1.738330	0.0822
AREA_D1	-14.94273	36.47039	-0.409722	0.6820
STATUS_D1	-48.33524	48.82143	-0.990042	0.3222
PERSHABIT	-4.436250	3.813718	-1.163235	0.2447
SHOPHABIT	-11.20675	7.179851	-1.560860	0.1186
PRODCHARAC	1.715829	11.76615	0.145828	0.8841
ATTITUDE	-10.76697	5.208807	-2.067071	0.0387
Error Distribution				
SCALE:C(16)	251.4009	19.92611	12.61665	0.0000

Mean dependent var	33.66188	S.D. dependent var	106.3343
S.E. of regression	105.4104	Akaike info criterion	4.304025
Sum squared resid	4077869.	Schwarz criterion	4.468956
Log likelihood	-808.2207	Hannan-Quinn criter.	4.369450
Avg. log likelihood	-2.110237		

Left censored obs	283	Right censored obs	0
Uncensored obs	100	Total obs	383

Dependent Variable: FWASTE_OIL
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:43
Sample: 1 394
Included observations: 385
Left censoring (value) at zero
Convergence achieved after 7 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-71.26613	127.0950	-0.560731	0.5750
AGE	2.284200	1.889804	1.208697	0.2268
INCOME	0.000696	0.000175	3.983151	0.0001
EXPEND	0.001489	0.001026	1.450598	0.1469
FAMMEMBER	-11.53351	9.575884	-1.204433	0.2284
CHILD	12.19687	12.49662	0.976013	0.3291
ELDER	-10.45707	14.41798	-0.725280	0.4683
EDU	-7.712328	2.951801	-2.612753	0.0090
GENDER_D1	16.84651	24.80742	0.679092	0.4971
AREA_D1	-20.29812	22.13261	-0.917114	0.3591
STATUS_D1	-18.91931	30.38450	-0.622663	0.5335
PERSHABIT	-1.468554	2.297335	-0.639242	0.5227
SHOPHABIT	4.033425	4.478789	0.900562	0.3678
PRODCHARAC	-12.92235	7.423830	-1.740658	0.0817
ATTITUDE	0.075657	3.133299	0.024146	0.9807
Error Distribution				
SCALE:C(16)	166.4483	10.93287	15.22458	0.0000

Mean dependent var	30.59740	S.D. dependent var	90.72409
S.E. of regression	85.63607	Akaike info criterion	5.342245
Sum squared resid	2706075.	Schwarz criterion	5.506535
Log likelihood	-1012.382	Hannan-Quinn criter.	5.407403
Avg. log likelihood	-2.629564		

Left censored obs	248	Right censored obs	0
Uncensored obs	137	Total obs	385

Dependent Variable: FWASTE_CEREAL
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/29/23 Time: 10:44
Sample: 1 394
Included observations: 384
Left censoring (value) at zero
Convergence achieved after 10 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-787.3904	295.7040	-2.662765	0.0078
AGE	8.482962	4.153410	2.042409	0.0411
INCOME	-0.000340	0.000468	-0.726057	0.4678
EXPEND	0.000146	0.002352	0.061981	0.9506
FAMMEMBER	-5.263584	21.32287	-0.246852	0.8050
CHILD	-2.254234	27.93351	-0.080700	0.9357
ELDER	0.545731	31.57955	0.017281	0.9862
EDU	8.268889	6.462363	1.279546	0.2007
GENDER_D1	35.18194	53.12389	0.662262	0.5078
AREA_D1	4.011294	47.06748	0.085224	0.9321
STATUS_D1	-7.265632	63.20509	-0.114953	0.9085
PERSHABIT	-4.058161	5.040975	-0.805035	0.4208
SHOPHABIT	0.306874	9.380800	0.032713	0.9739
PRODCHARAC	-16.26460	15.77792	-1.030846	0.3026
ATTITUDE	5.885858	6.610889	0.890328	0.3733
Error Distribution				
SCALE:C(16)	257.2673	34.57305	7.441266	0.0000

Mean dependent var	14.84375	S.D. dependent var	52.40036
S.E. of regression	52.88270	Akaike info criterion	2.024358
Sum squared resid	1029141.	Schwarz criterion	2.188968
Log likelihood	-372.6767	Hannan-Quinn criter.	2.089650
Avg. log likelihood	-0.970512		

Left censored obs	342	Right censored obs	0
Uncensored obs	42	Total obs	384

UGM

Dependent Variable: RICE_AND_NOODLES
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 13:53
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 7 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	72.99187	75.47060	0.967156	0.3335
AGE	-0.212007	1.026636	-0.206506	0.8364
INCOME	7.68E-07	1.25E-06	0.614003	0.5392
EXPENDITURE	-8.63E-07	2.54E-06	-0.339748	0.7340
FAMILY_MEMBER	16.02343	6.558169	2.443278	0.0146
NUMBER_OF_CHILDREN	7.874571	8.524335	0.923775	0.3556
NUMBER_OF_ELDERLY_PEOPLE	13.38599	10.60515	1.262215	0.2069
EDUCATION	0.325429	2.234240	0.145655	0.8842
D1__GENDER_	6.303775	23.92484	0.263482	0.7922
D2__AREA_	-27.39082	12.56164	-2.180513	0.0292
STATUS	51.48537	88.16544	0.583963	0.5592
PERSONAL_HABIT	-5.911414	1.688512	-3.500961	0.0005
SHOPPING_HABIT	3.162162	2.590291	1.220774	0.2222
PRODUCT_CHARACTERISTICS	-0.378041	4.375429	-0.086401	0.9311
MORAL_ATTITUDE	-5.034768	1.997459	-2.520586	0.0117
Error Distribution				
SCALE:C(16)	103.4942	6.309260	16.40354	0.0000

Mean dependent var	31.21212	S.D. dependent var	58.96294
S.E. of regression	56.39328	Akaike info criterion	5.812784
Sum squared resid	1208477.	Schwarz criterion	5.973649
Log likelihood	-1134.931	Hannan-Quinn criter.	5.876514
Avg. log likelihood	-2.865988		
Left censored obs	230	Right censored obs	0
Uncensored obs	166	Total obs	396

Dependent Variable: VEGETABLES_AND_FRUIT
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 18:35
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 26 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	145.5593	111.6894	1.303251	0.1925
AGE	-0.235931	1.576785	-0.149628	0.8811
INCOME	2.85E-06	1.84E-06	1.544089	0.1226
EXPENDITURE	-3.70E-06	3.83E-06	-0.965831	0.3341
FAMILY_MEMBER	1.967507	9.697959	0.202878	0.8392
NUMBER_OF_CHILDREN	-7.773526	13.19290	-0.589220	0.5557
NUMBER_OF_ELDERLY_PEOPLE	-4.814008	16.65996	-0.288957	0.7726
EDUCATION	2.146105	3.410051	0.629347	0.5291
D1__GENDER_	-32.31865	34.68725	-0.931716	0.3515
D2__AREA_	-4.202959	19.01623	-0.221020	0.8251
STATUS	-1092.140	20009904	-5.46E-05	1.0000
PERSONAL_HABIT	-6.060841	2.580057	-2.349112	0.0188
SHOPPING_HABIT	5.617343	3.943065	1.424614	0.1543
PRODUCT_CHARACTERISTICS	-8.455383	6.479941	-1.304855	0.1919
MORAL_ATTITUDE	-3.040227	3.008605	-1.010510	0.3123
Error Distribution				
SCALE:C(16)	160.2863	9.582636	16.72675	0.0000

Mean dependent var	55.87121	S.D. dependent var	88.43899
S.E. of regression	88.49326	Akaike info criterion	6.579270
Sum squared resid	2975802.	Schwarz criterion	6.740136
Log likelihood	-1286.696	Hannan-Quinn criter.	6.643000
Avg. log likelihood	-3.249231		
Left censored obs	219	Right censored obs	0
Uncensored obs	177	Total obs	396

Dependent Variable: MEAT
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 18:33
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 8 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	80.42712	89.34116	0.900225	0.3680
AGE	-2.306650	1.259341	-1.831633	0.0670
INCOME	-9.05E-07	1.57E-06	-0.574651	0.5655
EXPENDITURE	1.69E-06	3.02E-06	0.559193	0.5760
FAMILY_MEMBER	-2.150829	7.739343	-0.277908	0.7811
NUMBER_OF_CHILDREN	-0.909411	10.38088	-0.087604	0.9302
NUMBER_OF_ELDERLY_PEOPLE	-9.631871	13.24597	-0.727155	0.4671
EDUCATION	2.139097	2.665679	0.802459	0.4223
D1__GENDER_	33.70620	29.35842	1.148093	0.2509
D2__AREA_	3.703189	14.63796	0.252985	0.8003
STATUS	-1.514823	102.0286	-0.014847	0.9882
PERSONAL_HABIT	0.552937	1.959283	0.282214	0.7778
SHOPPING_HABIT	-6.311266	3.049959	-2.069295	0.0385
PRODUCT_CHARACTERISTICS	3.976821	5.040996	0.788896	0.4302
MORAL_ATTITUDE	-0.011104	2.326181	-0.004774	0.9962
Error Distribution				
SCALE:C(16)	122.8763	8.017001	15.32696	0.0000

Mean dependent var	45.07576	S.D. dependent var	59.38285
S.E. of regression	59.92310	Akaike info criterion	5.884323
Sum squared resid	1364495.	Schwarz criterion	6.045188
Log likelihood	-1149.096	Hannan-Quinn criter.	5.948052
Avg. log likelihood	-2.901757		
Left censored obs	235	Right censored obs	0
Uncensored obs	161	Total obs	396

Dependent Variable: EGGS
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 13:58
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 8 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	96.94696	162.4044	0.596948	0.5505
AGE	-1.992546	2.197603	-0.906691	0.3646
INCOME	-1.90E-06	2.90E-06	-0.654219	0.5130
EXPENDITURE	-1.61E-06	5.58E-06	-0.288643	0.7729
FAMILY_MEMBER	-8.806051	13.83947	-0.636300	0.5246
NUMBER_OF_CHILDREN	2.910711	18.45496	0.157720	0.8747
NUMBER_OF_ELDERLY_PEOPLE	24.81775	23.31346	1.064525	0.2871
EDUCATION	0.632589	4.716869	0.134112	0.8933
D1__GENDER_	22.49991	51.99825	0.432705	0.6652
D2__AREA_	4.609654	26.64109	0.173028	0.8626
STATUS	80.16873	186.5944	0.429642	0.6675
PERSONAL_HABIT	-0.084610	3.579234	-0.023639	0.9811
SHOPPING_HABIT	-6.841518	5.546881	-1.233399	0.2174
PRODUCT_CHARACTERISTICS	-2.762667	9.214019	-0.299833	0.7643
MORAL_ATTITUDE	4.728116	4.244148	1.114032	0.2653
Error Distribution				
SCALE:C(16)	226.3232	13.10133	17.27483	0.0000

Mean dependent var	64.77273	S.D. dependent var	129.6644
S.E. of regression	131.4327	Akaike info criterion	6.961006
Sum squared resid	6564328.	Schwarz criterion	7.121871
Log likelihood	-1362.279	Hannan-Quinn criter.	7.024735
Avg. log likelihood	-3.440099		
Left censored obs	216	Right censored obs	0
Uncensored obs	180	Total obs	396

Dependent Variable: SEASONING
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 18:34
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 30 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-4.800088	124.4390	-0.038574	0.9692
AGE	-0.037930	1.643963	-0.023073	0.9816
INCOME	-3.52E-06	2.55E-06	-1.380926	0.1673
EXPENDITURE	1.22E-05	4.25E-06	2.859485	0.0042
FAMILY_MEMBER	-14.15573	10.70082	-1.322865	0.1859
NUMBER_OF_CHILDREN	6.644536	13.45920	0.493680	0.6215
NUMBER_OF_ELDERLY_PEOPLE	19.81689	16.86632	1.174938	0.2400
EDUCATION	-2.096274	3.507766	-0.597609	0.5501
D1__GENDER_	38.64196	40.53026	0.953410	0.3404
D2__AREA_	-14.83020	19.85060	-0.747091	0.4550
STATUS	-960.8745	85629725	-1.12E-05	1.0000
PERSONAL_HABIT	-0.050561	2.565476	-0.019708	0.9843
SHOPPING_HABIT	1.944816	4.014915	0.484398	0.6281
PRODUCT_CHARACTERISTICS	-9.231743	6.808569	-1.355901	0.1751
MORAL_ATTITUDE	-4.958926	3.157858	-1.570345	0.1163
Error Distribution				
SCALE:C(16)	142.4607	10.46299	13.61567	0.0000

Mean dependent var	9.955808	S.D. dependent var	67.06610
S.E. of regression	67.49151	Akaike info criterion	3.981119
Sum squared resid	1730940.	Schwarz criterion	4.141985
Log likelihood	-772.2616	Hannan-Quinn criter.	4.044849
Avg. log likelihood	-1.950156		
Left censored obs	292	Right censored obs	0
Uncensored obs	104	Total obs	396

Dependent Variable: SOUP_AND_CURRY
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 18:35
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 30 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-105.1840	87.51647	-1.201876	0.2294
AGE	-0.750934	1.267397	-0.592501	0.5535
INCOME	-2.87E-06	1.78E-06	-1.610197	0.1074
EXPENDITURE	4.08E-06	3.07E-06	1.327809	0.1842
FAMILY_MEMBER	9.254404	7.531587	1.228746	0.2192
NUMBER_OF_CHILDREN	-6.644405	9.779027	-0.679455	0.4968
NUMBER_OF_ELDERLY_PEOPLE	-10.23487	12.61968	-0.811024	0.4174
EDUCATION	8.807899	2.723603	3.233914	0.0012
D1__GENDER_	5.951837	26.85383	0.221638	0.8246
D2__AREA_	-30.88499	14.34360	-2.153223	0.0313
STATUS	-815.0194	79374465	-1.03E-05	1.0000
PERSONAL_HABIT	1.793092	1.919394	0.934197	0.3502
SHOPPING_HABIT	-0.626995	2.869736	-0.218485	0.8271
PRODUCT_CHARACTERISTICS	-8.522957	4.984943	-1.709740	0.0873
MORAL_ATTITUDE	-4.706029	2.273426	-2.070016	0.0385
Error Distribution				
SCALE:C(16)	108.4624	7.886260	13.75334	0.0000

Mean dependent var	18.91414	S.D. dependent var	48.83051
S.E. of regression	48.80787	Akaike info criterion	4.406816
Sum squared resid	905239.1	Schwarz criterion	4.567681
Log likelihood	-856.5495	Hannan-Quinn criter.	4.470546
Avg. log likelihood	-2.163004		
Left censored obs	276	Right censored obs	0
Uncensored obs	120	Total obs	396

Dependent Variable: DAIRY_PRODUCTS
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 13:54
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 30 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-56.56655	204.9580	-0.275991	0.7826
AGE	-1.024024	2.907615	-0.352187	0.7247
INCOME	3.66E-06	2.81E-06	1.300512	0.1934
EXPENDITURE	4.98E-06	5.57E-06	0.893913	0.3714
FAMILY_MEMBER	-15.26002	18.10964	-0.842646	0.3994
NUMBER_OF_CHILDREN	8.617081	22.46976	0.383497	0.7014
NUMBER_OF_ELDERLY_PEOPLE	-32.04954	32.39152	-0.989442	0.3224
EDUCATION	0.372864	6.077977	0.061347	0.9511
D1__GENDER_	76.32973	69.49511	1.098347	0.2721
D2__AREA_	21.31808	32.65254	0.652877	0.5138
STATUS	-1246.947	1.21E+08	-1.03E-05	1.0000
PERSONAL_HABIT	-8.101352	4.460728	-1.816150	0.0693
SHOPPING_HABIT	-2.909712	6.775237	-0.429463	0.6676
PRODUCT_CHARACTERISTICS	0.963388	11.51494	0.083664	0.9333
MORAL_ATTITUDE	2.202124	5.225593	0.421411	0.6735
Error Distribution				
SCALE:C(16)	207.4211	20.13455	10.30175	0.0000

Mean dependent var	9.968434	S.D. dependent var	72.03605
S.E. of regression	72.45809	Akaike info criterion	2.693867
Sum squared resid	1995066.	Schwarz criterion	2.854733
Log likelihood	-517.3857	Hannan-Quinn criter.	2.757597
Avg. log likelihood	-1.306530		

Left censored obs	333	Right censored obs	0
Uncensored obs	63	Total obs	396

Dependent Variable: DRINKS_AND_BEVERAGES
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 13:55
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 27 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	339.5274	223.6533	1.518097	0.1290
AGE	-1.798338	3.100229	-0.580066	0.5619
INCOME	-2.90E-06	4.08E-06	-0.710185	0.4776
EXPENDITURE	-2.20E-06	7.83E-06	-0.280661	0.7790
FAMILY_MEMBER	-18.57616	19.76394	-0.939901	0.3473
NUMBER_OF_CHILDREN	-14.01122	27.40339	-0.511295	0.6091
NUMBER_OF_ELDERLY_PEOPLE	-13.22566	33.93917	-0.389687	0.6968
EDUCATION	-8.108620	6.535468	-1.240710	0.2147
D1__GENDER_	-105.1328	66.29912	-1.585734	0.1128
D2__AREA_	3.133803	37.22835	0.084178	0.9329
STATUS	-1814.041	51408367	-3.53E-05	1.0000
PERSONAL_HABIT	-3.829308	5.014422	-0.763659	0.4451
SHOPPING_HABIT	-5.272235	7.885016	-0.668640	0.5037
PRODUCT_CHARACTERISTICS	2.522826	12.65492	0.199355	0.8420
MORAL_ATTITUDE	1.989612	5.910867	0.336602	0.7364
Error Distribution				
SCALE:C(16)	284.4397	19.73519	14.41282	0.0000

Mean dependent var	34.29924	S.D. dependent var	137.9446
S.E. of regression	139.7897	Akaike info criterion	5.073302
Sum squared resid	7425645.	Schwarz criterion	5.234167
Log likelihood	-988.5138	Hannan-Quinn criter.	5.137032
Avg. log likelihood	-2.496247		

Left censored obs	273	Right censored obs	0
Uncensored obs	123	Total obs	396

Dependent Variable: OIL
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 18:34
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 28 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-6.858571	109.4956	-0.062638	0.9501
AGE	-0.916948	1.518098	-0.604011	0.5458
INCOME	4.02E-07	1.83E-06	0.219488	0.8263
EXPENDITURE	9.96E-07	3.72E-06	0.267777	0.7889
FAMILY_MEMBER	21.65126	9.592171	2.257181	0.0240
NUMBER_OF_CHILDREN	-5.789415	12.69679	-0.455975	0.6484
NUMBER_OF_ELDERLY_PEOPLE	-9.204934	16.82169	-0.547206	0.5842
EDUCATION	2.366795	3.383820	0.699445	0.4843
D1__GENDER_	-48.35209	33.63934	-1.437367	0.1506
D2__AREA_	-46.70353	18.50832	-2.523381	0.0116
STATUS	-1204.834	50458483	-2.39E-05	1.0000
PERSONAL_HABIT	1.456385	2.503422	0.581757	0.5607
SHOPPING_HABIT	-0.277933	3.787066	-0.073390	0.9415
PRODUCT_CHARACTERISTICS	-5.631096	6.339033	-0.888321	0.3744
MORAL_ATTITUDE	-2.527528	2.918325	-0.866089	0.3864
Error Distribution				
SCALE:C(16)	159.6177	8.227919	19.39952	0.0000

Mean dependent var	43.13763	S.D. dependent var	107.0809
S.E. of regression	108.2448	Akaike info criterion	7.579068
Sum squared resid	4452437.	Schwarz criterion	7.739933
Log likelihood	-1484.655	Hannan-Quinn criter.	7.642797
Avg. log likelihood	-3.749130		

Left censored obs	185	Right censored obs	0
Uncensored obs	211	Total obs	396

Dependent Variable: CEREAL_AND_BREAD
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 06/06/23 Time: 13:57
Sample: 1 396
Included observations: 396
Left censoring (value) at zero
Convergence achieved after 31 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	388.5425	402.7351	0.964759	0.3347
AGE	-0.628893	5.597513	-0.112352	0.9105
INCOME	-9.48E-06	8.83E-06	-1.073237	0.2832
EXPENDITURE	2.14E-05	1.35E-05	1.581465	0.1138
FAMILY_MEMBER	-93.24324	40.60912	-2.296116	0.0217
NUMBER_OF_CHILDREN	-50.87603	52.39559	-0.970998	0.3315
NUMBER_OF_ELDERLY_PEOPLE	-57.48018	66.43744	-0.865177	0.3869
EDUCATION	7.794820	12.07782	0.645383	0.5187
D1__GENDER_	-86.57991	110.2207	-0.785514	0.4322
D2__AREA_	-85.32996	66.40451	-1.285003	0.1988
STATUS	-2458.483	2.64E+08	-9.31E-06	1.0000
PERSONAL_HABIT	-13.77175	8.738648	-1.575959	0.1150
SHOPPING_HABIT	17.35217	13.23718	1.310865	0.1899
PRODUCT_CHARACTERISTICS	-25.47147	21.39531	-1.190517	0.2338
MORAL_ATTITUDE	-13.35064	10.57801	-1.262112	0.2069
Error Distribution				
SCALE:C(16)	376.3720	46.37386	8.116036	0.0000

Mean dependent var	22.34848	S.D. dependent var	93.87530
S.E. of regression	90.98034	Akaike info criterion	2.189949
Sum squared resid	3145420.	Schwarz criterion	2.350814
Log likelihood	-417.6099	Hannan-Quinn criter.	2.253679
Avg. log likelihood	-1.054571		

Left censored obs	350	Right censored obs	0
Uncensored obs	46	Total obs	396