UNIVERSAL WISER
PUBLISHER

Research Article

Is There a Food Waste Kuznets Curve? Some Evidence from China, Romania and Switzerland

Stefan Mann[1*] , Maria Bobeică[2] , Silviu Beciu[2] , Georgiana Armenita Arghiroiu[2]

[1]Agroscope, Ettenhausen, Switzerland
[2]University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania
 E-mail: stefan.mann@agroscope.admin.ch

Abstract: The environmental Kuznets curve is defined as the proposition that pollution increases in the early stages of economic development and decreases in advanced economies. It could be verified for many environmental parameters and is based on concepts that make it likely that it could also be applied to the occurrence of food waste in households. Within the frame of a comparative case study, a standardised survey on actual food waste behaviour in 1,510 Chinese, Romanian and Swiss households explore whether rich countries reduce their per capita food waste as compared to middle-income countries. Young people throw away more food than older ones, particularly in Switzerland, which appears to be in contradiction to the Kuznets curve. However, it can be shown that Romanian and Chinese consumers declare more food waste than consumers in Switzerland and that the differences between the countries can be explained by differences in attitudes and behaviour. This is an indicator that the concept of the Kuznets curve can be applied to the problem of food waste.

Keywords: food waste, comparative research, Kuznets curve, consumer behaviour, Romania, China, Switzerland

1. Introduction

The original Kuznets curve proposed an inverse u-shaped connection between inequality and growth [1]. The debate on this dynamic of distribution in an economy has paled in comparison with the attention that the environmental variant of the concept has been receiving. In what they call the environmental Kuznets curve, Grossman and Krueger [2] suggested that pollution would increase in the early stages of economic development but that regulations would then lead to decreasing pollution during further economic growth. Since that time, a lot of empirical evidence has suggested that the proposed correlation can be found for some environmental parameters but not for others [3]. The environmental Kuznets curve is a phenomenon that numerous researchers have refined [4-6] and that shows at least some validity.

In attempts to make our food system more sustainable, it has become increasingly obvious that the large share of food that is not ending up in our stomachs is one of the greatest causes of environmental pressure [7-9]. The Food and Agriculture Organisation [10] suggests that 8% of global greenhouse gases can be traced back to food waste. Food waste, however, is not a form of pollution by itself but a systemic, indirect cause of pollution, as a lot of resources have to be spent to grow the excess food. In the early stages of the food chain, food waste occurs due to quality requirements in the sector [11]. A major share of food waste is then caused by consumers purchasing more than they eat [12, 13]. According to the Economist Intelligence Unit [14], the amount of food wasted differs considerably between countries

and can exceed 400 kg per capita per year. However, little is known about the causes of these differences.

This paper has the objective of shedding some light on the relationship between a country's state of development and the amount of food waste caused in order to fill this relevant gap in knowledge. It uses the food waste caused by consumers as a case in point to argue that such behavioural patterns leading to pollution are also likely to follow some sort of Kuznets curve, as depicted in Figure 1. The figure describes a very plausible level of food waste close to zero when societies are in a state of poverty, an increase when wealth emerges, and then a significant reduction for very wealthy societies. A respective hypothesis will be developed and operationalised in the following section.
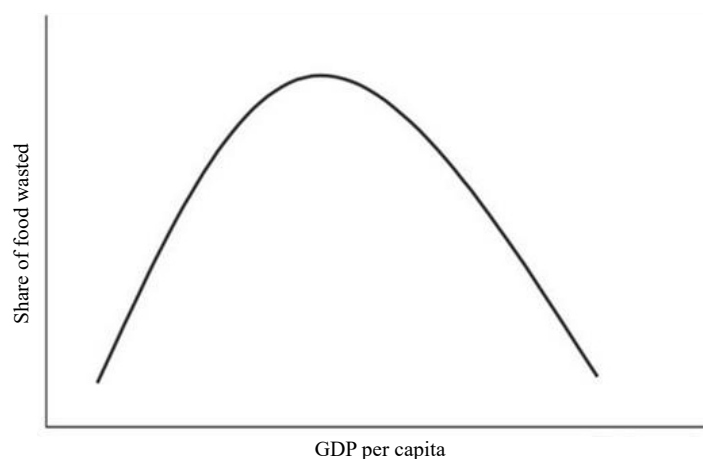

Figure 1. The hypothesised food waste Kuznets curve. Note: GDP = gross domestic product

2. Hypothesising the food waste Kuznets curve

In a recent literature review, Boulet et al. [15] criticised the fact that most studies on consumer behaviour with respect to food waste restricted themselves to a narrow set of micro factors, whereas macro perspectives would be more difficult to find. Indeed, comparisons regarding the food waste behaviour of consumers between countries are rare and usually compare similar Western countries, such as Germany and Italy [16] or the United Kingdom, France, and Italy [17]. To our knowledge, the analysis of food waste behaviour in emerging countries also suffers from a lack of comparative studies and focuses mostly on the microlevel [18-20].

A modelling paper by Lopez-Barrera and Hertel [21] provides a notable exception. Over the last 20 years, they looked at the food produced per country, modelled the food consumed, and, thus, provided estimates for food waste, finding the strongest growth rates in middle-income economies. Their analysis, however, does not allow a comparison of the amount of food wasted in households.

It is not difficult to argue why low-income countries, often with a record of undernutrition, will waste less food in households compared to middle-income countries (Lopez-Barrera and Hertel [21] did not find any evidence for food waste in Niger, for example). But would there be reasons to assume that the rates of food waste in wealthy societies would decline again, as indicated in Figure 1?

Frank's [22] reference to Maslow's hierarchy of needs may provide a key to that. Frank intended to show that there is an animal welfare Kuznets curve, as consumers in rich countries are able to reach the highest level of Maslow's [23] pyramid—self-actualisation—which includes altruistic motives such as altruism and benevolence. Increasingly, this top tier of Maslow's hierarchy also includes the demand for sustainability, as scholars from various disciplines, such as tourism [24, 25], education [26], and fashion [27], repeatedly emphasise.

If consumers in wealthy countries increasingly attempt to direct their lives sustainably, it is plausible to form the following hypothesis:

Hypothesis 1: Households in high-income countries waste less food than households in middle-income countries.

Moreover, if our reference to the Maslow hierarchy of needs is justified, consumers in middle-income countries

will have different values compared to consumers in affluent countries [28]. These values will translate into different attitudes and behavioural patterns, which leads to another hypothesis:

Hypothesis 2: Differences in household food waste between countries can be traced back to different attitudinal and behavioural patterns.

However, different cultures also play a role. The strong role of the family in Asian countries — as Siu and Chang [29], for example, emphasised—means that it can be assumed that the role of parental education in these countries will exceed this role in other parts of the world. This leads to the final hypothesis:

Hypothesis 3: The role of different attitudinal and behavioural patterns that influence food waste may vary between countries.

3. Method

Reliable international databases on food waste amounts at the household level do not exist, nor are the levels easily measurable. Therefore, our hypotheses could not be tested in a quantitatively significant sample of countries. Instead, we decided to carry out similar surveys in two middle-income countries and one high-income country: Consumers in China (GDP per capita US$14,000), with a centralised, self-reliant political system, and in Romania (GDP per capita US$15,000), as a Western-oriented, democratic country, are compared with consumers in Switzerland (GDP per capita US$96,000), as one of the wealthiest and most stable countries in the world.

The surveys were sent out and collected between winter 2021 and 2022 and spring 2022. In China, the survey was done electronically only and received 659 responses. In Switzerland, 1,400 paper questionnaires were distributed in letter boxes, resulting in a response rate of 24% (n = 342). In Romania, both paper and online questionnaires were distributed, resulting in a sample size of n = 509. The surveys contained a measure for the amount of food wasted and attitudinal, behavioural and sociodemographic variables to explain food waste.

The design of our questionnaire was influenced by Ammann et al. [30], who showed that self-reported amounts of food waste tend to be underestimated but are still a reliable tool to compare the behaviour between households. Therefore, a survey was carried out in which respondents were asked to quantify the food they would usually end up throwing away in six categories: meat and fish, fruit, vegetables, bread and pastry, dairy, and others. If they threw away nothing, they would score zero points in that category; for 0 to 10%, they scored one point, and so on. Shares above 40% were always considered five points. This led to a maximum score of 6 x 5 = 30.

Researchers have, particularly in recent years, advanced in identifying causes for food waste in the categories of sociodemographic, attitudinal and behavioural factors, on which the present study could focus and which were used for the survey, as indicated in Table 1. To start with the behavioural side, Reynolds et al. [31] and Salonen [32], for example, showed the importance of checking the contents of the fridge before shopping, so this was included as a variable for our survey. Principato et al. [33] indicated that making a shopping list would lead to less food waste. Smith and Landry [34] found that shopping frequency and the amount of food waste were positively correlated.

Regarding the attitudinal variables depicted in Table 1, for which external references were the inspiring source, Boesen et al. [35] identified a segment of consumers who openly do not care about food waste because it is biodegradable. Other studies [36, 37] have considered concerns over food waste being a waste of money as a major driver of the amount of food waste. Chen [38] suggested that environmental concerns are a suitable driver for reducing food waste. Finally, Kowalewska and Kollajtis-Dolowy [39] emphasised the strong role that parental education plays in reducing food waste.

On the side of personal variables, a European study confirmed that older people waste less food than young ones [40], whereas a positive correlation between income and food waste has been reported in Indonesia [41]. Finally, several studies [42-44] have indicated that household size influences the share of food thrown away, whereas it appears appropriate to separate the influence of adult and child family members.

Table 1. Descriptive statistics

Variable name	Meaning	Measurement	Minimum	Maximum	Mean
		Dependent variable			
Index	Share of food thrown away	1 unit per 10% of wasted food in six categories	0	29	5.63
		Behavioural variables			
Fridge	Agreement to "Before shopping, I take a look in the fridge"	1 – never to 5 – always	1	5	3.96
Shoplist	Agreement to "Before shopping, I make a list"	1 – never to 5 – always	1	5	3.42
Shopfreq	Frequency of shopping	1 – 0 to 2 times per week to 5 – 9 times per week or more	1	5	2.42
		Attitudinal variables			
Compost	Agreement to "Food is degradable; therefore, food waste does not affect the environment"	1 – totally disagree to 5 – totally agree	1	5	2.59
Money	Agreement to "Food waste is a waste of money"	1 – totally disagree to 5 – totally agree	1	5	3.91
Resources	Agreement to "By wasting food, I also waste resources like water and land"	1 – totally disagree to 5 – totally agree	1	5	4.30
Health	Agreement to "Eating leftovers is bad for my health"	1 – totally disagree to 5 – totally agree	1	5	2.54
Parents	Agreement to "My parents always emphasised to clear my plate"	1 – totally disagree to 5 – totally agree	1	5	4.21
		Sociodemographic variables			
Age	Respondent's age	In years	16	92	36.03
Income	Household income level	1 – lowest income quintile to 5 – highest income quintile	1	5	2.50
Adults	Number of adults in the household		0	33	2.80
Children	Number of children in the household		0	9	0.62

This setting was suited to testing the first two hypotheses. In order to also test the varying roles of factors for the single countries, as stated in Hypothesis 3, interaction terms between the independent variables and the two country dummies had to be tested.

The consumer food waste index was explained by an ordered logit analysis in Stata 16, as the index consisted of a number between 0 and 29 for each household. An ordered logit model for an ordinal response Y_i with C categories is defined by a set of C–1 equations where the cumulative probabilities:

$$g_{ci} = \Pr\left(Y_i \leq yc \vdots x_i\right) \tag{1}$$

are related to a linear predictor:

$$\beta'^{xi} = \beta0 + \beta1x1_i + \beta2x2_i + \cdots \beta'x_i \tag{2}$$

through the logit function:

$$logit\left(g_{ci}\right) = \log\left(\frac{g_{ci}}{1 - g_{ci}}\right) = \alpha_c - \beta'x_i, c = 1, 2, \ldots, C-1 \tag{3}$$

The parameters α_c, called thresholds or cutpoints, are in increasing order. The Lagrange multiplier test was conducted to test for heteroskedasticity and produced negative results.

4. Results and discussion

Table 2 depicts the descriptive results by country. The mere comparison of the three samples of the variable "Index" cannot, of course, formally confirm Hypothesis 1, but at least the strong differences in the self-stated amount of food wasted between China, Romania and Switzerland indicate that Hypothesis 1 cannot be rejected. In Romania, the amount of food wasted (with an "Index" of 7.33) seems to be almost three times as high as in Switzerland (with an "Index" of 2.65). It points towards some food waste Kuznets curve if, as is the case, the two middle-income countries in the sample have a much higher amount of per-capita food waste than the high-income country Switzerland. Our estimates are confirmed by a study using a more approximate methodology, which also concluded that middle-income countries generate the highest level of food waste per capita [45].

However, there are additional remarkable differences between the three countries. In fact, many of the items, as measured by five-point Likert scales, differ by more than one unit between countries. Shopping lists, for example, are much more common in Switzerland (3.93 for "Shoplist") than in China (2.87), and Romanian consumers go shopping much more often (3.38 for "Shopfreq") than consumers in China (2.23), let alone Swiss (1.53) consumers.

Attitudinal differences can also be identified. The main distinction lies within the question of whether eating leftovers is detrimental to health, which Chinese respondents seem to confirm (3.77 for "Health"), whereas European consumers clearly reject the idea (1.55 and 1.40). Chinese consumers, however, are slightly less convinced than Swiss consumers that wasting food harms the environment, as seen from the "Resources" variable.

The fact that the survey was carried out online only in China and on paper only in Switzerland had implications for the average age of respondents and goes some way to explaining why the sample population in China has a median age of four years below those in Romania and Switzerland. In addition, the household size in China was considerably larger than in Switzerland.

Table 3 unites the results of the three countries by running a single ordered logit analysis. This has two advantages as compared to running three single-country regressions. One is that, through interaction variables and country dummy variables, the differences between the three countries become more clear-cut. The other advantage is the emergence of overarching patterns that unite the three cases.

Proceeding to the explanation of the "Index" variable, it can be considered a success that neither country dummy is significant, in spite of the considerable differences between countries. This means that these differences can be explained by the independent variables in the survey. This fact means that we cannot reject Hypothesis 2. The large set of attitudinal and behavioural variables that influence food waste and which have been summarised by Dou and Toth [46] do a better job of explaining the variance in food waste-related behaviour than any cultural or country-specific influences.

The "Fridge" variable would be a good case in point for this pattern. Consumers who check their fridges before they do their grocery shopping will waste less food. Therefore, if Chinese consumers do this less frequently than Swiss consumers, the latter will throw less food away. Similarly, Swiss consumers go shopping less frequently than Romanians and usually use a list, unlike the Chinese. All this reduces their waste.

Most variables included in the questionnaire based on past research show some significant influence on the amount of self-declared food waste. Considering food waste as a waste of money, for example, will not contribute significantly to reducing food waste. Apparently, an increased awareness of the limited resources of our planet will do more to reduce food waste than an increased awareness of our purse. It also should be noted that fears of how eating leftovers affects our health significantly increase the amount of food we throw away.

The personal variables also do their jobs. While household size has only a very mild effect on the amount of food waste, the effects of both income and age are considerable. Young and rich consumers throw much more food away than elderly, poorer people.

Particular attention should be devoted to the interaction terms. They indicate, for example, that environmental awareness plays a role in reducing food waste in China and Switzerland but not in Romania, as can be concluded from the significantly positive interaction term "Resources X Romania". Here, the food waste Kuznets curve comes into close contact with the environmental Kuznets curve—if Romanians are less sensitive to pollution than, for example, Swiss consumers, they will not see too much merit in avoiding it.

The influence of the "Parents" variable is also noteworthy. Its strongly negative coefficient is somewhat neutralised by a negative interaction term for both Romania and Switzerland (see the significant variables "Parents X Switzerland" and "Parents X Romania" in Table 3). This confirms that the family in China (the reference country in the regression) has a higher impact on behavioural patterns than in the two European countries.

For Romania, the impact of income on food waste is also much weaker than in the other two countries, as can be concluded from the negative interaction term "Income X Romania". This is as difficult to explain as the increased age effect in Switzerland. While younger consumers throw away more food than older people, the results suggest that this effect is twice as strong in Switzerland as it is in the other two countries.

These are excellent examples of differences between the influencing factors that mean that we certainly cannot reject Hypothesis 3. Intercultural studies on a worldwide scale [47-49] help explain such diverging factors responsible for behavioural differences.

Table 2. Comparative results between countries

Variable name	Mean China	Mean Romania	Mean Switzerland
Dependent variable			
Index	5.85	7.33	2.65
Behavioural variables			
Fridge	3.72	4.05	4.29
Shoplist	2.87	3.76	3.93
Shopfreq	2.23	3.38	1.53
Attitudinal variables			
Compost	2.62	2.31	2.93
Money	4.04	3.41	4.28
Resources	4.07	4.33	4.70
Health	3.77	1.55	1.40
Parents	4.34	4.09	4.12
Sociodemographic variables			
Age	26.26	37.72	52.77
Income	2.38	2.21	3.11
Adults	3.67	2.39	1.73
Children	0.61	0.73	0.48

Table 3. Results of the ordered logit analysis in the explanation of "Index"

Country dummies	
Romania	-0.71
	(-0.99)
Switzerland	-1.07
	(-1.42)
Behavioural variables	
Fridge	-0.30***
	(-5.60)
Shoplist	0.08°
	(1.71)
Shopfreq	0.17***
	(3.06)
Attitudinal variables	
Compost	0.11***
	(2.65)
Money	-0.05
	(-1.08)
Resources	-0.28***
	(-3.35)
Health	0.20***
	(3.57)
Parents	-0.52***
	(-4.56)
Sociodemographic variables	
Age	-0.02***
	(-4.48)
Income	0.33***
	(5.27)
Adults	0.06°
	(1.86)
Children	0.09
	(1.60)
Interaction variables	
Resources X Romania	0.20°
	(1.70)
Parents X Romania	0.34***
	(2.72)
Parents X Switzerland	0.36**
	(2.46)
Income X Romania	-0.20°
	(-1.83)
Age X Switzerland	-0.02*
	(-2.20)

Note: *** = $p < 0.001$; ** = $p < 0.01$; * = $p < 0.05$; and ° = $p < 0.1$

A study that involves only three countries can, of course, not fully answer the question of whether there is a Kuznets curve for food waste. It can only find indications, and, fortunately, the survey among Chinese, Romanian, and Swiss consumers has indeed found such indications. These indications, however, go in opposing directions.

There are clear signs that food waste at the household level in the two middle-income countries in our study, Romania and China, is at a higher level than in Switzerland, mostly due to different attitudes and resulting behaviours in the three countries. The descriptive statistics displayed in Table 2 have shown that Romanians like to go to the supermarket frequently, whereas Chinese consumers go there without a shopping list, and both are patterns that, as we know from the literature as well as from the data in this paper, go along with increased food waste. All this supports the hypothesis of a food waste Kuznets curve.

On the other hand, this study, as well as a number of others [50, 51], indicates that young people waste more food than the elderly. This does not generate optimism that, over the course of the next decades, as the older generations make room for the young ones, food waste will become less as societies become wealthier. In particular, it should be remembered that the impact of age in Switzerland exceeds the impact of age in the two emerging countries. One could even conclude that Switzerland is going to catch up to the level of food waste that Romanian and Chinese consumers incur.

5. Conclusion

In any case, our results show that it should be a priority to target young people with both educational measures and incentives so that food waste is increasingly avoided. It is unlikely that a Kuznets curve for food waste will just occur in the wake of economic development. It is more likely that a smart design of appropriate policies can lead to a food waste Kuznets curve, that is, to an inverse relationship between economic growth and the share of food that ends up in the bin. Future research should be able to dissolve the apparent contradiction between the country effect (that supports a food waste Kuznets curve) and the age effect (that makes a food waste Kuznets curve less likely).

Conflict of interest

There is no conflict of interest in this study.

References

[1] Kuznet S. Economic growth and income inequality. *American Economic Review*. 1955; 45(1): 1-28. https://assets. aeaweb.org/asset-server/files/9438.pdf
[2] Grossman GM, Krueger AB. Economic growth and the environment. *The Quarterly Journal of Economics*. 1995; 110(2): 353-377. https://doi.org/10.2307/2118443
[3] Dinda S. Environmental Kuznets curve hypothesis a survey. *Ecological Economics*. 2004; 49(4): 431-455. https:// doi.org/10.1016/j.ecolecon.2004.02.011
[4] Bravol G, Marelli B. Micro-foundations of the Environmental Kuznets Curve hypothesis: An empirical analysis. *International Journal of Innovation and Sustainable Development*. 2007; 2(1): 36-62. https://doi.org/10.1504/ IJISD.2007.016057
[5] He J, Wang H. Economic structure, development policy and environmental quality: An empirical analysis of environmental Kuznets curves with Chinese municipal data. *Ecological Economics*. 2012; 76: 49-59. https://doi. org/10.1016/j.ecolecon.2012.01.014
[6] Shabaz M, Mutascu M, Azim P. Environmental Kuznets curve in Romania and the role of energy consumption. *Renewable and Sustainable Energy Reviews*. 2013; 18: 165-173. https://doi.org/10.1016/j.rser.2012.10.012
[7] Grizzetti B, Pretato U, Lassaletta L, Billen G, Garnier J. The contribution of food waste to global and European nitrogen pollution. *Environmental Science and Policy*. 2013; 33: 186-195. https://doi.org/10.1016/ j.envsci.2013.05.013
[8] Melikoglu M, Lin CSK, Webb C. Analyzing global food waste problem pinpointing the facts and estimating the

energy content. *Central European Journal of Engineering*. 2013; 3: 157-164. https://doi.org/10.2478/s13531-012-0058-5

[9] Muller A, Schader C, El-Hage Scialabba N, Brüggemann J, Isensee A, Erb KH, et al. Strategies for feeding the world more sustainably with organic agriculture. *Nature Communications*. 2017; 8(1): 1-13. https://doi.org/10.1038/s41467-017-01410-w

[10] Food and Agriculture Organization of the United Nations. *Food wastage footprint & climate change*. https://www.fao.org/3/bb144e/bb144e.pdf [Accessed 13th April 2023].

[11] Raak N, Symmank C, Zahn S, Aschemann-Witzel J, Rohm H. Processing- and product-related causes for food waste and implications for the food supply chain. *Waste Management*. 2017; 61: 461-472. https://doi.org/10.1016/j.wasman.2016.12.027

[12] Willersinn C, Mack G, Mouron P, Keiser A, Siegrist M. Quantity and quality of food losses along the Swiss potato supply chain. *Waste Management*. 2015; 46: 120-132. https://doi.org/10.1016/j.wasman.2015.08.033

[13] Canali M, Amani P, Aramyan L, Gheoldus M, Moates G, Östergren K, et al. Food waste drivers in Europe, from identification to possible interventions. *Sustainability*. 2016; 9(1): 37. https://doi.org/10.3390/su9010037

[14] Economist Intelligence Unit. *Fixing food: Towards a more sustainable food system*. Parma, Italy: Barilla Center for Food and Nutrition Foundation. 2016. https://www.disag.unisi.it/sites/st07/files/allegatiparagrafo/05-03-2018/fixing_food_-_bcfn.pdf

[15] Boulet M, Hoek AC, Raven R. Towards a multi-level framework of household food waste and consumer behaviour Untangling spaghetti soup. *Appetite*. 2021; 156: 104856. https://doi.org/10.1016/j.appet.2020.104856

[16] Jörissen J, Priefer C, Bräutigam K-R. Food waste generation at household level: Results of a survey among employees of two European research centers in Italy and Germany. *Sustainability*. 2015; 7(3): 2695-2715. https://doi.org/10.3390/su7032695

[17] Bravi L, Francioni B, Murmura F, Savelli E. Factors affecting household food waste among young consumers and actions to prevent it. A comparison between UK, Spain and Italy. *Resources, Conservation and Recycling*. 2020; 153: 104586. https://doi.org/10.1016/j.resconrec.2019.104586

[18] Aschemann-Witzel J, Gimenez A, Ares G. Household food waste in an emerging country and the reasons why: Consumer's own accounts and how it differs for target groups. *Resources, Conservation and Recycling*. 2019; 145: 332-338. https://doi.org/10.1016/j.resconrec.2019.03.001

[19] Matzembacher DE, Viera LM, Dutra de Barcellos M. An analysis of multi-stakeholder initiatives to reduce food loss in an emerging country – Brazil. *Industrial Marketing Management*. 2021; 93: 591-604. https://doi.org/10.1016/j.indmarman.2020.08.016

[20] Qian L, Li F, Liu H, Wang L, McCarthy B, Jin S. Rice vs. Wheat: Does staple food consumption pattern affect food waste in Chinese university canteens? *Resources, Conservation and Recycling*. 2022; 176: 105902. https://doi.org/10.1016/j.resconrec.2021.105902

[21] Lopez-Barrera E, Hertel T. Global food waste across the income spectrum. *Food Policy*. 2021; 98: 101874. https://doi.org/10.1016/j.foodpol.2020.101874

[22] Frank J. Is there an "animal welfare Kuznets curve"? *Ecological Economics*. 2008; 66(2-3): 478-491. https://doi.org/10.1016/j.ecolecon.2007.10.017

[23] Maslow AH. A theory of human motivation. *Psychological Review*. 1943; 50(4): 370-396. https://psycnet.apa.org/doi/10.1037/h0054346

[24] Lacher RG. *Serious tourism and consumer preference for sustainable tourism certifications*. PhD thesis. Clemson University; 2012. https://www.proquest.com/openview/1e6da5d8808f8d9eac1a67f907802e41/1?pq-origsite=gscholar&cbl=18750

[25] Sloan P, Legrand W, Kinski S. The restorative power of forests the tree house hotel phenomenon in Germany. *Advances in Hospitality and Leisure*. 2016; 12: 181-189. https://doi.org/10.1108/S1745-354220160000012009

[26] Rachelson A. Sustainability education the community college perspective. *Journal of Sustainability Education*. 2014; 6: 147-153. http://www.jsedimensions.org/wordpress/wp-content/uploads/2014/05/Rachelson-Anouchka-JSE-May-2014-PDF-Ready.pdf

[27] Lam LH, Watkins J. Pre-owned fashion as sustainable consumerism? Opportunities and challenges in the Vietnam market. *Journal of Fashion Marketing and Management*. 2023; 27(4): 577-594. https://doi.org/10.1108/JFMM-03-2022-0067

[28] Kahle LR, Homer PM, O'Brien RM. Maslow's hierarchy and social adaptation as alternative accounts of value structures. In: Kahle LR, Chiagouris L. (eds.) *Values, Lifestyles and Psychographics*. New York: Psychology Press; 1997. p.111-137.

[29] Siu AFY, Chang JF. Coping styles and psychological distress among Hong Kong university students validation of

the collectivist coping style inventory. *International Journal for the Advancement of Counselling.* 2011; 33(2): 88-100. https://psycnet.apa.org/doi/10.1007/s10447-011-9114-8

[30] Ammann J, Osterwalder O, Siegrist M, Hartmann C, Egolf A. Comparison of two measures for assessing the volume of food waste in Swiss households. *Resources, Conservation and Recycling.* 2021; 166: 105295. https://doi.org/10.1016/j.resconrec.2020.105295

[31] Reynolds C, Goucher L, Quested T, Bromley S, Gillick S, Wells VK, et al. Review: Consumption-stage food waste reduction interventions - What works and how to design better interventions. *Food Policy.* 2019; 83: 7-27. https://doi.org/10.1016/j.foodpol.2019.01.009

[32] Salonen AS. Ordinary overflow: Food waste and the ethics of the refrigerator. *Food and Foodways.* 2022; 30(3): 145-164. https://doi.org/10.1080/07409710.2022.2089828

[33] Principato L, Secondi L, Pratesi CA. Reducing food waste: An investigation on the behaviour of Italian youths. *British Food Journal.* 2015: 117(2): 731-748. https://doi.org/10.1108/BFJ-10-2013-0314

[34] Smith TA, Landry CE. Household food waste and inefficiencies in food production. *American Journal of Agricultural Economics.* 2021; 103(1): 4-21. https://doi.org/10.1111/ajae.12145

[35] Boesen S, Bey N, Niero M. Environmental sustainability of liquid food packaging: Is there a gap between Danish consumers' perception and learnings from life cycle assessment? *Journal of Cleaner Production.* 2019; 210: 1193-1206. https://doi.org/10.1016/j.jclepro.2018.11.055

[36] Watson M, Meah A. Food, waste and safety: Negotiating conflicting social anxieties into the practices of domestic provisioning. *Sociological Review.* 2013; 60(S2): 102-120. https://doi.org/10.1111/1467-954X.12040

[37] Graham-Rowe E, Jessop DC, Sparks P. Identifying motivations and barriers to minimising household food waste. *Resources, Conservation and Recycling.* 2014; 84: 15-23. https://doi.org/10.1016/j.resconrec.2013.12.005

[38] Chen HS. Environmental concerns and food consumption: What drives consumers' actions to reduce food waste? *Journal of International Food & Agribusiness Marketing.* 2019; 31(3): 273-292. https://doi.org/10.1080/08974438.2018.1520179

[39] Kowalewska MT, Kollajtis-Dolowy A. Food, nutrient, and energy waste among school students. *British Food Journal.* 2018: 120(8): 1807-1831. https://doi.org/10.1108/BFJ-11-2017-0611

[40] Grainger MJ, Aramyan L, Logatcheva K, Piras S, Righi S, Setti M, et al. The use of systems models to identify food waste drivers. *Global Food Security.* 2018; 16(1): 1-8. https://doi.org/10.1016/j.gfs.2017.12.005

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

[42] Zhang H, Duan H, Andric JM, Song M, Yang B. Characterization of household food waste and strategies for its reduction: A Shenzhen City case study. *Waste Management.* 2018; 78: 426-433. https://doi.org/10.1016/j.wasman.2018.06.010

[43] Grasso AC, Olthof MR, Boevé AJ, van Dooren C, Lähteenmäki L, Brouwer IA. Socio-demographic predictors of food waste behavior in Denmark and Spain. *Sustainability.* 2019; 11(12): 3244. https://doi.org/10.3390/su11123244

[44] Qian K, Javadi F, Hiramatsu M. Influence of the COVID-19 pandemic on household food waste behavior in Japan. *Sustainability.* 2020; 12(23): 9942. https://doi.org/10.3390/su12239942

[45] United Nations Environment Programme. *Food waste index report 2021.* https://www.unep.org/resources/report/unep-food-waste-index-report-2021 [Accessed 4th January 2023].

[46] Dou Z, Toth JD. Global primary data on consumer food waste: Rate and characteristics – A review. *Resources, Conservation, and Recycling.* 2021; 168: 105332. https://doi.org/10.1016/j.resconrec.2020.105332

[47] Zhangh Z, Tan S, Wignell P, O'Halloran K. Addressing international students on Australian and Chinese university webpages: A comparative study. *Discourse, Context & Media.* 2020; 36, 100403. https://doi.org/10.1016/j.dcm.2020.100403

[48] Naidoo P. *Intercultural communication: A comparative study of Japanese and South African work practice.* PhD thesis. University of Zululand; 2011. https://hdl.handle.net/10530/593

[49] Tenescu A. Perspectives of intercultural advertising and marketing. In: Stanescu G, Strunga AC, Negrea XN. (eds.) *Recent trends in social sciences.* Craiova: Sitech, 2021. p.77-85. https://doi.org/10.5281/zenodo.5784603

[50] Bilska B, Tomaszewska M, Kolozin-Krajewska D. Analysis of the behaviors of Polish consumers in relation to food waste. *Sustainability.* 2020; 12(1): 304. https://doi.org/10.3390/su12010304

[51] Gonzales-Santana RA, Blesa J, Frigola A, Esteve MJ. Dimensions of household food waste focused on family and consumers. *Critical Reviews in Food Science and Nutrition.* 2022; 62(9): 3242-2354. https://doi.org/10.1080/10408398.2020.1853033