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Measuring the Impacts of a Save Food Campaign to Reduce Food Waste on Campus in Thailand

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Abstract

This study measured the impact of an awareness campaign to reduce food waste on campus. Information cues were installed at strategic locations in a canteen to engage university students in food waste prevention. Stickers with food ordering tips were placed in front of the food vendors. Information cards about resource use in food production were placed on dining tables to remind students to finish what they had ordered. Other materials of the save food campaign such as posters and banners carried messages and images to elicit a pro-environmental norm. Students were also encouraged to share their support through social media in order to increase the visibility of the actions. The analysis showed that carefully designed information was effective in changing behaviors. Based on the visual analysis of returned food containers, the share of those who finished all their food nearly doubled after the campaign. The types of food waste on the information cards were also significantly reduced. However, the results showed that voluntary behavior changes are limited to actions requiring little additional effort. Other types of interventions such as rule-based measures, economic incentives and changes in physical settings and how food is served should be considered to further food waste prevention. In addition, reuse and recycling options are needed for fluid and other unavoidable food waste.

Keywords: Pro-environmental behavior; Environmental education; Food waste; Awareness campaign; Nudging; Waste prevention

Introduction

Food is one of our basic needs and a tremendous amount of resources and energy is devoted to food production. Environmentally Extended Input Output Analysis (EE IOA) has consistently showed that satisfying our final demand for food is among the top contributors to resource use and environmental impacts [1, 2]. Water footprint and virtual water are emerging concepts that underline the environmental consequences of agricultural production [3]. However, all the inputs and impacts would be for naught if food was wasted. Tristram Stuart's book, *Waste: Uncovering the Global Food Scandal* [4], provided a glimpse into the extent of global food wastage. Seminal works of the Food and Agriculture Organization of the United Nations (FAO) later estimated that about one third of food is lost or wasted [5] and that this amplifies impacts on natural resources [6]. Production of methane, a potent greenhouse gas, and other local impacts from food waste have led several countries to take actions. The Landfill Directive (1999/31/EC) restricts the amount of biodegradable waste the Member States can send to landfill from 2016 to 35% of 1995 level. In South Korea, the landfill ban of food waste has been fully effecttive since 2005. The diversion of food waste from landfill will be advantageous especially in terms of climate mitigation [7, 8].

According to the waste management hierarchy, the diversion strategy should give the first priority to waste reduction [9]. Although a considerable amount of food waste is generated along the supply chain due to poor facilities in developing countries and market-based standards in developed countries, post-consumer waste has a high potential for prevention [5, 10]. While some food waste items such as peels and bones are unavoidable, most post-consumer food waste can be prevented. A composition analysis in Norway found that three quarters of the 3.76 kg of food waste per household generated every week was edible [11]. Life-cycle assessment (LCA) shows that the avoidance of every ton of post-consumer food waste could result in a reduction of greenhouse gases in the range of 800-1400 kgCO_2eq [12].

Awareness campaigns are a necessary component and the most popular measure to engage consumers in food waste prevention [10, 13]. Such campaigns convey information about the gravity of the problem and suggest ways consumers can help reduce food waste. A carefully-designed campaign can activate a personal moral norm through enhancing awareness of adverse consequences and an ascription of responsibility that trigger behavioral change [14-17]. Several studies have confirmed the theory of planned behavior [18] that psycho-social factors such as intentions, attitudes, personal norms, and perceived behavioral controls influence the generation of food waste [19-22].

This article presents an action research to reduce the generation of post-consumer food waste at a Thai university. In 2014 Mae Fah Luang University (MFU) collaborated with the FAO Regional Office for Asia and the Pacific to carry out an on-campus awareness campaign. MFU is a medium-sized university located in Chiang Rai, with approximately 12,000 full-time students. The setting and the target group provided a challenging backdrop. Multilevel analysis showed that generation of food waste tended to increase with urbanization at a city level; at the individual level, higher-educated people tended to generate more food waste [23]. The campaign was thus a critical part of the green university policy because awareness should be instilled in the students in order to reverse this trend and reduce the environmental load of the urbanized campus. This will contribute to our efforts to achieve Target 12.3 of the Sustainable Development Goals (SDGs): "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses" [24].

The article is organized into four sections. The next section describes the three cycles in the action research: establishing the baseline, designing the campaign, and implementing the intervention. The results of the research are presented and discussed in Section 3. The last section provides concluding remarks and presents some recommendations.

Materials and Methods

This action research consisted of three cycles. The first cycle focused on the understanding of food waste generation on the campus. The baseline was established by monitoring the generation of post-consumer food waste at a main university canteen at D1 Building where students were requested to return their food containers to designated collection points. Returned containers were handled by janitors who separated containers and utensils from different vendors, food waste, and other residues. This arrangement allowed the collection of visual data of food waste on individual containers retuned at the designated points.

The collection of visual data was based on systematic sampling. Staff manned the three designated points with digital cameras to photograph returned containers. A picture was taken for every five persons that returned food containers. The protocol was tested on 30 June 2014 where 188 pictures were taken. Two modifications were made after the debriefing with staff. First, the interval was increased to every ten persons during busy lunch hours; the interval for the morning hours remained at five. Second, in the actual data collection, two cameras were used at each designated point to keep separate records of food containers returned by male and female students.

The pilot testing helped to frame the data analysis. Visual data were analyzed in two steps. The first step rated the quantity of leftover food in retuned containers. Table 1 provides a short description of the six-point scales and examples. In the second step, the types of food waste for those rated between "1" and "5" were classified into eight categories: rice and noodles; edible meat and eggs; special (edible) animal parts (e.g. skin, intestines, fat); non-edible animal parts (e.g. bones, shells); edible main vegetables and fruit; edible side vegetables (e.g. cucumber, tomato, spring onion); non-edible vegetables and fruit (e.g. peelings, seeds); and fluids (e.g. soup, sauces). In addition to the probability, the main type of food waste was identified for each picture.

Baseline data was collected in August and September 2014. Three waves of data were collected to ascertain the patterns of food waste generation. Table 2 reports the number of pictures from breakfast and lunch hours. Out of the 319 pictures collected during the three waves, 314 were valid while the other 5 were too blurred for visual analysis. As a Chi-Square test did not detect any significant difference (Pearson Chi-Square = 8.987, df = 10, p-value = 0.533), data from the three waves will be reported together as the "baseline" in Section 3.

The awareness campaign was also integrated as part of problem-based learning (PBL) for the course, "Products and Environmental Impact" (PEI, course code 1107402), in the first semester of the 2014 academic year (August-December). Students enrolled in the course were asked to keep a photo-diary of their food and food waste for a period of two weeks. Although this method might introduce bias as diary keepers became sensitized to waste generation [20], in this case the purpose of the exercise was not to quantify but to provide an understanding of the process that led to generation of food waste. A focus-group session was then organized to reflect on the types and causes of wastage. The students then learned about environmental impacts relating to food waste and theories of environmental behaviors. The course project was instrumental to the design of the information campaign

implemented in the second cycle of the action research. The campaign is described in Section 3.

The third cycle featured the intervention and monitoring of campaign impacts. The campaign was launched on 17 November 2014. The impact of the campaign on food waste was monitored between 19 and 21 November using the same protocol with the collection of baseline data. In total 148 pictures were taken in this wave: 55 from breakfast hours and 93 from lunch hours. All 148 pictures could be analyzed visually.

Table 1 Rating scales of food waste quantity and examples

Scale	Description	Examples
0	No food waste (0% wasted)	
1	Very small quantity (1-20% wasted)	
2	Small quantity (21-40% wasted)	
3	Considerable quantity (41-60% wasted)	
4	Large quantity (61-80% wasted)	
5	Very large quantity (81-100% wasted)	

Table 2 Collection of baseline data at a university canteen (unit: pictures)

	Breakfast	Lunch	Total
13 August	58	44	102
22 August	56	51	107
22-23 September	59	46	105

Results and Discussion

1) Baseline for food waste generation

Figure 1 shows the baseline data. Based on the visual analysis of 314 valid pictures, the share of students who finished all their food was 11%. The majority (38%) left a very small amount, or a small amount (30%) of food waste on their plates and bowls. 16% of the sample generated a considerable quantity of food waste. Wasting a large or a very large portion of food was rare, found in only 5% of the sample. This pattern was gender-neutral (Pearson Chi-Square = 8.565, df = 5, p-value = 0.128). There was also no significant difference between breakfast and lunch behaviors (Pearson Chi-Square = 4.087, df = 5, p-value = 0.537).

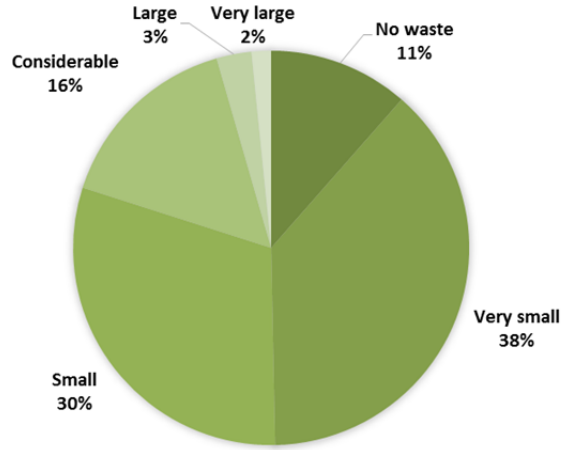

Figure 1 Breakdown of baseline food waste generation (n = 314)

Food served in bowls was more likely to be left in larger quantities than that on plates (Figure 2, Pearson Chi-Square = 31.538, df = 5, p-value = 0.000). Only 3.7% of returned bowls were empty compared to 17.3% of returned plates. This is understandable as the classification of food waste showed that the fluid fraction of food had the third highest probability to be found as waste in the returned containers (p = 0.399); only side vegetables (p = 0.650) and rice and noodle (p = 0.521) had a higher probability. For the 128 bowls with food waste, fluid waste was identified as the main type of food waste in more than half of them. On the other hand, the dominant types of food waste on plates were rice and noodle followed by side vegetables.

Results from a focus group discussion based on the student food/waste diaries provided an understanding of the main causes of food waste generation. Leftover rice or noodles occurred simply because they were given too much of it. Students tended to stop eating it when all other food was finished. Meat and vegetables were wasted due largely to personal preferences. Some were selective and did not eat intestines, fatty parts, and certain decorative side vegetables such as cucumber, spring onion or tomato. Taste also mattered. When the taste of food was off, e.g. too sweet, too salty or too spicy, a large quantity of food waste on a scale 4 or 5 could be generated. It was also observable from the diaries that most of the time students did not finish soup in a bowl; neither did they finish all sauces provided.

Figure 2 Examples of food waste pictures.

2) The awareness campaign

Based on this understanding of the causes of food waste generation, three tools were designed for the information campaign. The analysis of baseline data and the course project showed that food waste could be prevented when food was ordered. The stickers shown in Figure 3 contained not only the tagline of the campaign, which can be translated as “Do not waste food, please join us” but also gave food ordering tips. Three messages were tailored to fit different types of food vendors at the canteen. For curry-on-rice vendors who sold ready-made food, the focus was on the quantity, reminding the students to “ask for the right amount of rice”. For the cook-to-order and noo-

dle shops, the focus was either on taste, ("Ask for the taste you like"), or the ingredients, ("Ask for what you can eat"). The tips enhanced students' perception of their control over the generation of food waste. Each vendor received two stickers, one in Thai and the other in English, to be put up in front of his/her shop.

The second tool reminded students to finish what they had ordered. The information cards (Figure 4) targeted three types of food: rice, side vegetables and meat. According to the baseline data, the first two types had the highest probabilities of being left over. Meat, with the fourth highest probability (p = 0.186) was selected for study due to the high environmental impacts involved in its production. The cards provided information regarding key resource use and environmental impacts relating to each type of food, and ended with a strongly-worded negative statement [25]: "Don't let it go to waste". Rice is a staple food in Thailand and the cultivation period is almost equal to one university semester. Beef production is known as a major source of greenhouse gases. The water footprint of side-vegetables was presented using cucumber which was also the FAO's mascot as an example. The cards also contained the QR code to allow access to the Green University fanpage. In total, 210 cards were printed and affixed on every dining table at D1 canteen during the campaign.

The last set of materials was designed to capture the attention of the campaign targets. These included FAO's Save Food posters, human-sized signposts, and banners. The three banners (Figure 5) created a social norm for saving food on campus. One banner showed a picture of students from Southeast Asia to highlight that this was an international issue, while the other two showed pictures of cooks and janitors involved in handling food and food waste on campus, giving the campaign authenticity and realism. These materials were placed at the entrance and the container returning points at the D1 canteen.

After the campaign was launched on 17 November 2014, students from the PEI course acted as campaigners for one week during lunch breaks at the D1 canteen. Because waste prevention actions often suffer from low visibility [26], those who finished all their food were encouraged to share the picture of their emptied plates with a personal message and a hashtag, #savefoodmfu on social media.

Figure 3 Stickers with food ordering tips to prevent food waste

Figure 4 Nudging cards to encourage students to finish their food

Figure 5 Campaign banners to create a social norm for save food on campus

3) Impact of the campaign

Figure 6 shows the level of generation of food waste after the campaign. The pattern difered significantly from the baseline (Pearson Chi-Square = 26.284, df = 5, p-value = 0.000). The share of those who could finish all the food had almost doubled to 20%. It was likely that the campaign had an effect on those who otherwise might leave a very small amount of food to eat that last bit of their meals. Further analysis revealed that the campaign might affect females more than males. The share of clean containers without any food waste from female students rose from 11.1% to 25.7% while that of male students increased only slightly from 12.4% to 14.9%. Although campaign activities concentrated at lunch time, there was no significant difference between the share of clean dishes during breakfast (18.2%) and lunch hours (21.5%) (Pearson Chi-Square = 10.163, df = 5, p-value = 0.071).

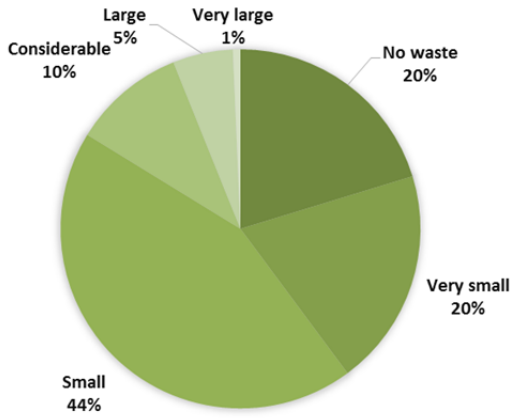

Figure 6 Breakdown of food waste generation after the campaign (n = 148)

Table 3 compares the probability that different types of food waste were found on the pictures before and after the campaign. All three types of food that were on the information cards were less likely to be wasted than the other types of food. This indicated the effectiveness of the nudging strategy. The share of containers with left-over rice and noodle plummeted from over one half to just a third. The probability of wasting meat was also reduced by half. The impact on side vegetables, although noticeable, was only moderate, with more than 50% wasting them. So, nudging alone was not sufficient and might need to be supplemented with a change in the physical setting of how food was served. An experiment in reducing plate size in addition to a nudging tool proved an effective combination in curbing the amount of food waste from a hotel buffet [27]. A self-serving arrangement that allowed students to pick their own might also contribute to reduced wastage of vegetables in this case. The campaign also had little impact on fluid waste, which was one of the top three types of waste. As Thai dishes often came with soups or sauces that would not be finished, it was necessary to think of how to reuse or recycle the left-overs in addition to the reduction efforts.

Table 3 Probability of occurrence of different types of food waste before and after the campaign

Type of food waste	*p* before the campaign	*p* after the campaign	Chi-Square (df =1)	p-value
1. Rice and noodle	0.521	0.331	14.556	0.000
2. Meat	0.186	0.088	7.395	0.007
3. Animal parts	0.121	0.122	0.000	0.985
4. Bones and shells	0.077	0.074	0.008	0.929
5. Main vegetables	0.076	0.047	1.364	0.243
6. Side vegetables	0.650	0.561	3.376	0.066
7. Peels and seeds	0.022	0.007	1.427	0.232
8. Soup and sauces	0.399	0.399	0.000	0.988

Conclusion

An awareness campaign was a basic response to reduce food waste; this study examined the extent to which such a measure could contribute to food waste prevention. The action research showed that an effective campaign required careful study of the context in order to craft the information cues that not only raise awareness of the problem among the target groups, but also increase their ability to act and their perceived behavioral control. The ordering tips and nudging cards in the campaign were, thus, rather specific and practically focused on the food waste items that could otherwise be avoided. Nevertheless, the results showed that voluntary behavior changes were limited to actions requiring little additional effort. Other types of interventions such as rule-based measures, economic incentives and changes in physical settings and how food is served should be considered to increase the further reduce food waste. In addition, reuse and recycling options are needed for fluids and other unavoidable food waste. Future research should engage more in the evaluation of media effectiveness both qualitatively, e.g. tonal bias, negative vs positive statement, and quantitatively, to measure the size of impacts.

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