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Urban Community Engagement to Reduce and Prevent Food Waste at Household Level

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Abstract.
Indonesia faces a food waste problem, particularly at the household level. Food waste causes negative impacts on several aspects such as environment, society, and economy. Ironically, at the same time, Indonesia also has a serious hunger problem. Through community development programs, we aimed to empower households in recycling their food waste by eco enzyme and their awareness through an online challenge. Eco enzyme is an affordable and useful method to recycle food waste being a liquid product with many benefits such as insect repellent, organic fertilizer, general cleaner, air purifier, and laundry cleaner. The total participants of the eco enzyme workshop were 57 people. On the other hand, through an online campaign #MelawanFoodWate, 101 users took action to be conscious customers in shopping behavior. These activities were in collaboration with several stakeholders to ensure the success of the program. These programs can be considered an initiation to develop Food Smart City that focuses on the community-based movement and circular economy.

Keywords: *Eco enzyme, food waste, household, online campaign, urban communities*

I. INTRODUCTION

According to the Food and Agriculture Organization of the United Nations (FAO), about one-third of the food produced does not end up on our plates. It even is thrown to the trash [1]. The Economist & Intelligence Unit [2] stated that Indonesia is the second-largest country after Saudi Arabia, which produces food waste and food loss in the world. This phenomenon may leads to an adverse impacts on the economy, the environment that contributes to greenhouse gas emissions, as well as nutrition losses [3];[4];[5];[6];[7];[8].From 60% of total waste in Indonesia, only 7.5 of them are

being processed [9]. However, the precise data about it is still limited in developing countries, such as Indonesia [10]. The total food waste in developing countries is lower than in developed countries. For example, the comparison of the amount of food waste between Europe, North America, and South/Southeast Asia is estimated at 95 kg, 115 kg, and 11 kg per annum, respectively [11]. At household level, they contribute approximately half of the total food waste [12];[13];[14];[15].

Consumer behaviour that is easily tempted with shopping promotion or product's discount of triggering food waste at the household level [16].Indonesia ranks 70 out of 119 countries with index hunger score 21.9, behind other Southeast Asia countries such as the Philippines, Cambodia, Thailand, Malaysia, and Vietnam [17]. World Food Programmes [18] reported that 19.4 million of Indonesian people facing malnutrition issues. In addition, the percentage of stunted children under five years old was 29%. This number of stunting was equal to 63% of total stunted children in Southeast Asia [19]. The gap between food waste and hunger problems can threaten food security in a country [20]. Research reports show that food waste can be significantly decreased by campaign and action to change the behaviour of costumers [21];[22]. To develop a way of reducing food waste, particularly at the household level, we have realized community engagement through online and offline methods. The community development programs aim to empower households for recycling food waste in simple ways and improve awareness through an online challenge.

II. METHODS

2.1. Community Engagement Framework

Urban communities were being our focal target in this program as they often produce a greater amount of food waste than rural citizens at the household level (Figure 1). To cover this issue, we developed a workshop and campaign for urban communities to manage their food waste. The following four parameters were used as pillars of our programs, i.e.:

1. Availability: The physical availability of the material used
2. Accessibility: Programs should be simple and considerate the socio-economic aspects of participants
3. Utilization: The programs bring positive impacts to the community
4. Sustainability: Programs can be sustained and reduplicated

The success of the four parameters can be achieved by collaboration with as many stakeholders related (Figure 2). As the first step, we performed stakeholders mapping with conducting to differentiate, identify, investigate, and categorize the link between relevant stakeholders. We use the matrix of interest-influence that has four criteria (i.e., victims, stakeholders who can make differences, stakeholders who need to be made more responsible, and bystanders). Two axes were used based on the process of contrasting and comparing the selected initiative. A matrix for stakeholder analysis was formulated with the x-axis of used approaches, conventional (left) and digital

(right), as well as y-axis of main categories, non-governmental organization (NGO's) (top) and startups/private sectors (bottom) [23].

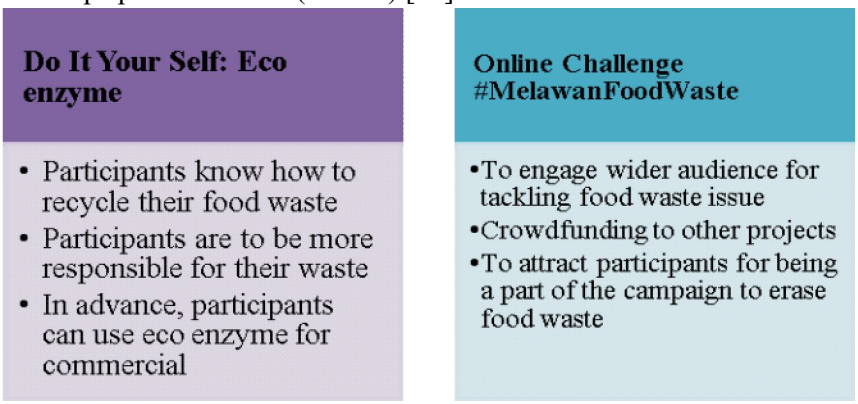

Fig 1. Outcomes of programs to urban community engagement

The curriculum used in the workshop was The Golden Circle theory [24]. We started with the question of "why" (questions of the purpose). It is crucial to ensure participants understand the danger of food waste, as seen from environmental, social, and economic perspectives. Therefore, they know the reasons why they should make the eco enzyme and participate in the online challenge. The second was the question of "how" (questions of the process). This was correlated with the production process, application, tips, and do-do not regarding eco enzyme and online challenge. The last was the question of "what" (questions of the product). In this part, the participants can understand the benefits of the eco enzyme and the online challenge.

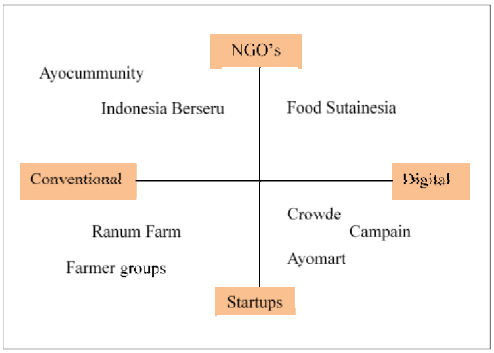

Fig 2. Stakeholders matrix of interest-influence

2.2. Do It Yourself: Eco-enzyme

We organized a workshop to train urban citizens regarding eco-enzyme. We conducted this workshop in @america, Jakarta. Eco-enzyme, which can also be called as a garbage enzyme, is the fermentation of fresh produce waste at home invented in 2006 by Dr. Rosukon Poompanyong, the founder of the Organic Agriculture Assosiation of Thailand (OAT), as his effort to fight global warming. Eco -enzyme is a vinegar-like liquid can be obtained after three months of fermentation process using

organic solid waste [25]; [26]. Decomposing fruits and vegetables to eco enzyme can be alternative to reduce greenhouse gases (methane and nitrous oxide) [27]; [28].

2.3. Online Challenge

#MelawanFoodWaste challenge (Figure 3) was conducted by using the Campaign #ForChange mobile phone application, which can be downloaded in Google Play Store or App Store. Campaign #ForChange is a platform connecting public, communities, and funders regarding social issues. The challenge was conducted in September 2019 to April 2020 and introduced by three events such as (1) tanipanen launching, (2) 20 social actions for 2020, and (3) Happiness Festival. The procedures of the challenge were:

1. Download Campaign #ForChange in Playstore or Appstore.
2. Click "Challenge #MelawanFoodWaste".
3. Upload pictures of a shopping to-do list prior to going to the supermarket. It can be a daily, weekly, or even monthly list.
4. Encourag people to reduce food waste in caption column with making a shopping to-do list before going to the supermarket.
5. Share the post to encourage the other people for joining this challenge.

Fig 3. Poster of challenge #MelawanFoodWaste in Campaign #ForChange

III. RESULT AND DISCUSSION

3.1. Do It Yourself Eco Enzyme

During the workshop, which was attedned by 57 participants of urban communities, we trained them in making eco-enzyme. There were two facilitators who demonstrate how to make it step by step, the benefits, as well as do's and dont's in making eco-enzyme. In this workshop, we used orange peels and apple pomaces as both of them have been reported success for the eco enzyme utilization [29]; [30]; [31]; [32]. The following are in-order procedures to make eco-enzyme we have used:

1. Use water, the waste of fruits and vegetables, brown sugar, with 10:3:1, respectively.
2. Copp waste of fruits and vegetables into small pieces.

3. Mix all ingredients into a bottle of mineral water.
4. Close a bottle of mineral water and leave it for three months in a sheltered space.
5. Open the container every once a week to release the trapped gasses and to prevent an explosion.
6. After three months, the color of eco enzyme will be a dark brown color with a vinegary smell.
7. Filter the liquid from the organic waste residue. This waste residue can be used for fertilizer and the liquid component for the eco enzyme.

Table 1. Enzyme from Fruits and vegetables waste

Enzyme	Fruits and Vegetables	References
Amylase	Cabbage, potato and pumpkin, mosambi, pomegranate, pineapple, papaya, citrus, tomato	Neupane & Khadka, 2019; Rasit et al., 2019; Rahman et al., 2020
Lipase	Cabbage, potato, pumpkin, pomegranate, citrus, tomato	Neupane & Khadka, 2019; Rasit et al., 2019; Rahman et al., 2020
Protease	Cabbage, potato and pumpkin, citrus, tomato	Rasit et al., 2019; Rahman et al., 2020
Caseinase	Mosambi, pomegranate, pineapple, papaya	Neupane & Khadka, 2019

Eco enzyme has great potency as biocatalytic and antimicrobial solution [33]; [34]; [35]; [36]; [37]. Investigation of antimicrobial activities showed that eco-enzyme inhibited Escherichia coli, Staphylococcus aureus, Rhizobium leguminosarum, Salmonella Typhi, Shigella spp., and Pseudomonas aeruginosa [38]; [39]; [40]. A variety of eco enzyme from fruits and vegetables waste also contains several enzymes such as amylase, protease, cellulase, lipase, and caseinase (Table 1) [41]; [42]; [43].Eco enzyme can be used as an insect repellent, organic fertilizer, general cleaner, air purifier, and laundry cleaner [44]; [45]; [46]; [47]. In India, there was a campaign called “mana ooru mana neeru”, which aimed to clean water bodies by using eco enzyme.

Three months after campaign, there was a significantly change in the dissolved oxygen (DO), biological oxygen demand (BOD) and chemical oxygen demand (COD) of the pond added with eco enzyme [48]. It experiments using eco enzyme as an addition to sewage water, the condition of sewage water changed clean [49]. Eco enzyme can reduce the percentage of COD of 77%, total suspended solids (TSS) of 87%, total phosphorus (TP) of 99%, volatile suspended solids (VSS) of 67%, and total ammonia nitrogen (TAN) of 91% [50]. The eco enzyme also significantly reduced

solids from 884 to 745, pH from 6.7 to 7.2, suspended solids from 121 to 47 hardness, and chlorides [51].

Fig 4. Workshop DIY Eco enzyme with citrus peels and apple pomace

3.2. Online Challenge #MelawanFoodWaste

Up to January 2020, the total of internet users in Indonesia reached + 175.4 M, and this number increased by +17% between 2019 and 2020. In average, Indonesian users spend 7 hours 59 minutes of their time each day to access the internet, which is longer than globally [52]. This fact can be an opportunity, particularly in a social campaign to reach massive audiences and boarder scope. For instance, several countries organize food waste campaigns, such as WRAP in the United Kingdom with "Love Food Hate Waste" and the collaboration of the United Nations Environment Programmes (UNEP), FAO, and Messe Dusseldorf with "Think. Eat. Save" [53].

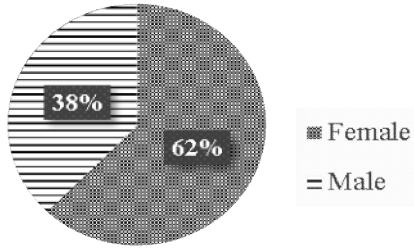

Fig 5. Percentage of users in the online challenge #Melawan Food Waste based on gender

101 users took action in the online challenge #MelawanFoodWaste. We counted six users who took double action. Besides, five users come from organizations, so we did not count it. If it is categorized by gender, 62% of users were female, and 40% of users were male (Figure 5). It depicts that shopping is still a female's domestic stuff. The users were dominated by millennials and gen Z. Generally, they are a digital generation and also have a concern in social issues [54]. In the stage of awareness, users posted the shop list in the application where people mostly wrote in a note in their handphone (Figure 6). This campaign was also crowdfunding action, whereas every action will convert to IDR 5,000 and every 100 users will receive an additional IDR 500,000. The utilization of the result of crowdfunding depends on the community.

This campaign is necessary because individual awareness is a critical factor preventing food waste [55]; [56].

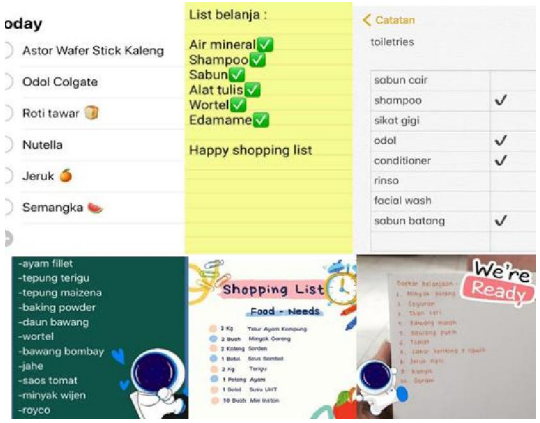

Fig 6. Shopping list of users in application of Campaign#ForChange

IV. CONCLUSION

Some activities to improve awareness of the urban community on food waste issues in Indonesia had been done through eco enzyme offline workshop and online challenge #MelawanFoodWaste. As 57 participants of the eco enzyme workshop and 108 users, the online campaign has involved in both activities. The result of crowdfunding will be used to support our other social activates. It is recommended for the cities government and related stakeholders to establish a system of Food Smart City. Under this system, waste is managed by (1) a circular economy concept that processes organic waste to the other utilizations such as energy, compost, and feeding livestock, (2) food bank to distribute surplus food to marginal communities, and (3) citizen empowerment to recycle or process their food waste to reduce food waste.

V. ACKNOWLEDGMENTS

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