Applying the Pro-Circular change model to restaurant and retail businesses’ preferences for circular economy: evidence from Indonesia

Ilmiawan Auwalin\textsuperscript{a}, Rumayya\textsuperscript{a}, Faradilla Rahma Sari\textsuperscript{b} and Saskia Rizqina Maulida\textsuperscript{b}

\textsuperscript{a}Faculty of Economics and Business, Universitas Airlangga, Surabaya, Indonesia; \textsuperscript{b}Research Institute of Socio-Economic Development, Surabaya, Indonesia

\textbf{ABSTRACT}

This study aims to examine the impact of persuasive communication as a behavioral change intervention for the pro-circular behavior of restaurant and retail business actors. The Pro-Circular Change Model (P-CCM) with an extended formulation of the Theory of Planned Behavior is used as the underlying framework. In the analysis, we employ a paired t-test to capture the differences before and after the intervention. We find evidence that behavioral change interventions are relatively effective in altering how individuals view the efforts needed to implement features of a pro-circular economy in their business. We also find that persuasive communication is relatively effective in promoting public awareness about current environmental issues. However, we find no significant impact on behavioral intention to implement circular economy strategies.

\textbf{Introduction}

The issue of food waste is becoming more concerning as it generates greater social and environmental costs as well as contributes to decreased resilience of the food-supply chain (Melikoglu, Lin, and Webb 2013; Munesue and Masui 2019; Bajželj, Quested, Roos, and Swannell 2020; Skaf, Franzese, Capone, and Buonocore 2021). In the case of Indonesia, food waste is a particularly important matter. According to The Economist Intelligence Unit (2017), an average person in Indonesia produces around 300 kilograms (km) of food waste per year. This makes Indonesia the second largest producer of food waste in the world after Saudi Arabia. Based on data from the National Waste Management Information System, food waste accounted for almost 40% of the country’s total waste stream in 2020. Furthermore, a recent report of the Indonesia National Development Planning Agency (Bappenas 2021) shows that Indonesian lost and wasted approximately 23-47 million tons per year since 2000 to 2019. These observations indicate the urgency of the food-waste issues in Indonesia.

There have been to date several studies of food waste in Indonesia, with most of them mainly focused on household generation (Soma 2017a, 2017b, 2020; Pamela et al. 2019; Amir, Hophmayer-Tochik, and Kurnani 2015). Other studies examine the relationship between consumers’ level of knowledge and awareness of food waste (Fox et al. 2018).

Only a few studies to date have examined the reduction of food waste by business operators such as by managers of small restaurants (Zahara et al. 2019) and by supply-chain managers (Rombe et al. 2018).

Food waste is not only generated by the household sector, but also produced throughout the supply chains of the food industry (Mena, Adenso-Diaz, and Yurt 2011). In this regard, the United Nations Food and Agriculture Organization (FAO 2019) reported that around 33% of global food is discarded along the supply chain. This finding suggests that food producers and distributors also play important roles in producing food waste. One of the ways to minimize food waste is through the implementation of strategies that are informed by an understanding of a circular economy (Borrello et al. 2017; Dora 2019; Lehtokunnas et al. 2020; Slorach et al. 2019, 2020; Vilarino et al. 2017).

A circular economy is an economic system where, as long as possible, resources are kept in use (Muranoko et al. 2018). The concept aims to optimize the utilization of an object and preserve the value of it (Stahel and MacArthur 2019). The concept started with the idea of circularity in society. In the early period of humankind, circularity provided the most effective way to make use of scarce natural resource as a life-survival strategy (Stahel and MacArthur 2019; Melles 2021). In the modern world, the concept has been adapted as an economic...
framework, especially by the industrial sector to maintain value and to enhance efficiency.

While the circular economy system could bring benefits, studies indicate that business sectors are often reluctant to adopt related strategies into their business models because of a preconceived notion that implementation requires greater effort than more customary business processes (Pan et al. 2015). Business managers often assume that the application of circular economy would involve structural changes in supply chains and require extra costs for labor-training programs and technological infrastructure. Moreover, business managers also often perceive the cost of restorative and regenerative activities as relatively more expensive compared to the utilization of raw materials (Lieder and Rashid 2016; Singh and Ordoñez 2016) and this leads to higher production costs (Palm, Nilsson, and Åhman, 2016; Shahbazi et al. 2016).

Lack of understanding of the circular economy concept, as well as the potential benefits that can be generated through its implementation, is attributed to the low adoption of circular economy by business (EMF 2019). Moreover, the absence of direct and apparent experience based on actual practice often leads to a reluctance to integrate circularity into business models. One of the ways to overcome this obstacle is by providing persuasive communication to stimulate pro-circular behaviors. Interventions based on persuasive communication can be used to address insufficient understanding of circular economy issues, which might influence behavioral intention (Liu and Bai 2014). Persuasive communication is one of the most common methods informed by the theory of planned behavior (TPB) (Hardeman et al. 2002; Muranko et al. 2018). This mode of communication involves delivery of specifically designed belief-targeting messages through verbal and non-verbal components (Tessier et al. 2015). Specifically to this point, Ajzen (2006) argues that belief-targeted messages in persuasive communication make this approach highly effective in changing the attitudes and intentions of individuals.

This study aims to examine the influence of persuasive communication in promoting pro-circular behaviors in the restaurant and retail sectors which are the second largest food-waste producers in Indonesia after households. The framework of the Pro-Circular Change Model (P-CCM) is employed in this study. This model is deemed suitable for this purpose because it is able to identify individual pro-circular behaviors from a behavioral perspective (Muranko et al. 2018). The data to measure the effectiveness of persuasive communication are obtained through three consecutive stages. First, a pre-intervention survey collected data on participants’ initial perceptions. Second, we exposed participants to a video intervention delivering belief-targeting messages about circular economy practices in the restaurant and retail sectors. Finally, a post-intervention survey was administered immediately after the video exposure. The results of the paired t-test, measuring the differences before and after the intervention, suggest a positive and statistically significant impact of the persuasive communication on individuals’ attitudes, perceived behavioral control, and awareness of environmental issues.

The remainder of this article proceeds as follows. The next section reviews literature on the context of the study which is focused on the case of Indonesia. The third section presents the theoretical framework and research methods. The fourth section describes the results and analysis and the final section summarizes the conclusions of the study.

**Literature review**

Several studies have demonstrated that the implementation of a circular economy could provide incentives for social inclusion and eventually lead to a transformation of food systems (see, e.g., Fassio and Minotti 2019; Principato et al. 2019). In contrast to the concept of recycling which utilizes waste by changing its use, the notion of a circular economy is based on the law of conservation of energy which states that energy can neither be created nor destroyed, it is only converted from one form to another. Accordingly, byproducts or residual materials should never become wastes that have no use at all.

Liu and Bai (2014) highlight how a better knowledge of circular economy concepts does not necessarily result in an increased level of willingness to adopt related business models as there could be other factors that might come into play. Related work by Govindan and Hasanagic (2018) reveals that governments, among other stakeholders, hold a determining role in implementation of practices consistent with a circular economy. In this regard, adoption could be encouraged by supportive regulations and policies such as tax or subsidy schemes. However, these systematic efforts do not necessarily mean that such measures will induce effective community response and participation. Thus, governments also need to understand the perspectives of other stakeholders. This issue remains mostly under-explored in Indonesia because there have been to date only a few studies that have considered the role of a circular economy in food-waste management and this work has been carried out largely from the vantage point of businesses.
Research undertaken in Italy reveals that producers tend to oversupply the market with their products as long as there is a high demand and market potential, coming at the cost of the quality of their products (Cicatiello et al. 2016). By contrast, retail sectors such as supermarkets often impose standards for quality based on numerous factors which can include the size and the weight of a product. Because the disposal cost is cheaper than the cost of producing non-disposable products, business managers are often unwilling to add after-life value in the design of their products (FAO 2018).

Producers often influence the behavioral tendencies of consumers in consuming food products (Singh and Giacosa 2019; Stancu, Haugaard, and Lähteenmäki 2016). For example, producers influence their customers to buy larger volumes than are necessary by making use of the psychology of the decision-making process such as the anchoring effect. For example, “buy one, get one free” offers often lead consumers to purchase more food than they need. The anchoring effect refers to a cognitive bias whereby individuals tend to use the first piece of information that they receive to make subsequent judgments (Tversky and Kahneman 1974). Considering the influence of producers on the choices of their customers, it is therefore important to study the implementation of circular economy from the standpoint of producers on the supply chain side (Govindan and Hasanagic 2018).

There have been a number of empirical studies on the preferences of businesses toward a pro-circular economy. Rovanto and Bask (2021), for instance, examined how companies transitioned to a circular economy from a linear economy model (adopters) and how companies founded on the sustainable principles of a circular economy implemented a circular business model at the level of the company, the supply chain, and the society. Similarly, Aranda-Usón (2020) investigated the adoption process of different circular economy-related activities by businesses from a regional perspective. Other studies have examined the barriers and enablers to decision-making process such as the anchoring effect. For example, “buy one, get one free” offers often lead consumers to purchase more food than they need. The anchoring effect refers to a cognitive bias whereby individuals tend to use the first piece of information that they receive to make subsequent judgments (Tversky and Kahneman 1974). Considering the influence of producers on the choices of their customers, it is therefore important to study the implementation of circular economy from the standpoint of producers on the supply chain side (Govindan and Hasanagic 2018).

Context of the study

Waste management in Indonesia is generally not carried out in an integrated manner. Particularly in urban areas, solid waste consists of various types of refuse, including discarded food, that is collected and handled using the open-dumping and landfill methods (Damanhuri, Handoko, and Padmi 2014; Andriani 2016; Meidiana and Gamse 2011; Munawar et al. 2018; Sudibyo et al. 2017; Wibisono et al. 2020). The open-dumping method is the simplest way to handle waste and involves leaving the discarded materials in open space without further processing. Meanwhile, the landfill method involves flattening waste using heavy equipment and then covering the surface with soil. Both methods are not sustainable, yet are widely used throughout cities in Indonesia (Meidiana and Gamse 2011; Munawar et al. 2018).

In Indonesia’s rural communities, waste management, including the eventual disposal of food waste, tends to be carried out using traditional means such as open burning which is usually done independently by households (Fafrlikova et al. 2020; Purba et al. 2014; Rachman et al. 2016). As a general rule, waste management in Indonesia does not meet the standards for sustainable waste management and current practices threaten the environment by producing soil and air pollution (Andriani and Atmaja 2019; Kristanto and Koven 2019; Rahim et al. 2012).

This study was carried out in the Greater Area of Surabaya, East Java, Indonesia. As the second largest metropolitan city in Indonesia, Surabaya faces more complex challenges in its waste-management systems compared to other smaller cities and districts (Wibisono, Firdausi, and Kusuma 2020). While Surabaya is known as one of the cleanest and greenest cities in Indonesia (Wardhani and Dugis 2020), it also faces many of the same problems related to waste management that are common throughout the country. The concept of a circular economy in waste management has not been widely implemented in the city. For example, Surabaya has been developing a system for managing plastic waste by establishing a waste-to-energy power plant in the Benowo Landfill (Sulistyowati and Astuti 2020).

Food-waste management is one of the serious issues for the city as the amount of food waste occupies the highest percentage of the total waste in Surabaya. According to several studies, the amount of food waste reaches up to 48.77% of the city’s total waste (Dhokhikah, Trihadiningrum, and Sunaryo 2015; Siaputra, Christianti, and Amanda 2019).
In addition to the food waste from households, discarded food also comes from the food-services sector. According to the Department of Culture and Tourism of Surabaya, there are 87 large restaurants, 776 small restaurants, and 14 food courts which dispose of organic and inorganic waste on a daily basis. Organic waste from the food-services sector is estimated to comprise 2.64% of Surabaya’s total waste stream.

A qualitative study by Sulistyowati and Astuti (2020) on waste management by restaurants in Surabaya found that they do not manage their waste in a sustainable way and simply dump the discarded food into garbage bins without even sorting organic and inorganic materials. The bins are then emptied by fee-charging garbage-collection services. According to Regional Regulation Number 5 of 2014 on Waste Management and Hygiene, waste management in Surabaya mainly relies on the landfill method so the food waste commonly ends up in municipal solid-waste landfills.

Restaurants and retailers play a significant role in contributing to the production of food waste because, especially in the urban area, eating in restaurants and going grocery shopping in supermarkets are becoming features of lifestyles (Syaukat et al. 2021). Food waste from restaurants is mostly due to the undermanaged supply of food ingredients and minimal knowledge about optimal food processing. Meanwhile, waste from food retailers, both traditional and modern, is caused by the poor management of supply and demand. Also, the type of product sold by food retailers consists mostly of perishable products such as fruit and vegetables which have short shelf lives (Daryanto and Sahara 2016).

In recent years, food waste has started to become a concern, especially in the urban areas of Indonesia. For instance, by harnessing the rise of startups and innovation in the digital sector, several local communities and nongovernmental organizations (NGOs) in the country have developed food banks such as Surplus.id, Foodbank of Indonesia, Foodcycle Indonesia, and Garda Pangan. Garda Pangan is based in Surabaya and the organization connects food-waste generators with people who need food. For example, the organization has a program called “Gleaning” to help local farmers who have extra harvest but do not have a way to sell the surplus to the market. This initiative reduces financial losses for agricultural producers and limits the extent of food waste. However, awareness of Garda Pangan’s campaign is still limited and highlights the potential for food-waste management in both Surabaya and Indonesia more generally based on a circular economy.

Theoretical framework and research methods

**Pro-Circular change model and the extension of theory of planned behavior**

This study employs the Pro-Circular Change Model (P-CCM) as its conceptual framework. This approach is deemed suitable because of its potential to identify individual pro-circular behaviors from a behavioral perspective (Muranko et al. 2018, 2019). The elements of the theory of planned behavior, as originally formulated by Ajzen (1985), are embedded in this approach and have been shown to be effective in predicting household-waste management and recycling behaviors (Botetzagias, Dima, and Malesios 2015; Chen and Tung 2010; Daviset al. 2006; Khan et al. 2020). Most of this work, however, has focused on intention and decision making at the household level (Geiger et al. 2019) and only a handful of studies have applied this approach to organizations (cf. Khan et al. 2020). Specifically, the predispositions of business managers to adopt behaviors consistent with a pro-circular economy remain unexplored.

To examine pro-circular behaviors among managers in the restaurant and retail sectors, this study, following the framework of Muranko et al (2019), uses two selected constructs of P-CCM: behavioral change intervention and behavioral intention. In the first construct, we use persuasive communication as a form of intervention to promote pro-circular behaviors among restaurant and retail business managers. We use persuasive communication because it is one of the most common methods in behavioral change-intervention studies (Hardeman et al. 2002; Muranko et al. 2018). Persuasive communication involves the delivery of belief-targeting messages, through both verbal and non-verbal components (Tessier et al. 2015), that can influence individuals’ behavioral intention (Ajzen 2006). In this case, we specifically use a persuasive video intervention because it has been empirically found to have positive influence on promoting pro-circular behaviors (Oh et al. 2020).

Meanwhile, in the second construct, we employ the extended version of TPB instead of the original one used in P-CCM. The use of an extended version in this study is deemed necessary as the original TPB does not consider other determining factors that have been shown to have influence on pro-circular behaviors, such as habit and environmental awareness (Elzinga 2018). In the original framework of TPB proposed by Ajzen (1985), behavior is directly influenced by intention, which in turn, is affected by three different factors: attitude toward behavior (ATB), subjective norms (SN), perceived behavioral control (PBC) (see
Figure 1). First, ATB is conceptualized as the degree to which the performance of a behavior is positively or negatively perceived. Second, SN refers to the perceived social pressure from other people, especially those who are important and can influence intention in performing a behavior. Finally, PBC is defined as beliefs about the degree of internal and external controls over the performance of a behavior.

In the case of pro-circular and environmentally related behaviors, however, TPB has been found to have a number of shortcomings. First, TPB excludes the importance of habit in influencing behavior and a number of studies have shown that habit interacts with intention in determining behavior (i.e., Gardner, de Bruijn, and Lally 2011; van Lenthe, Kremers, and Brug 2008). In a meta-analysis study conducted by Gardner, de Bruijn, and Lally (2011), for instance, the authors report that habit correlates with behavior. Elzinga (2018) also found that habit is a positive contributor to behavioral intention. Although behavior is directly influenced by intention, habit may affect behavior in familiar settings, such as in the case of a waste-management system which is related to daily operations. In this unvarying situation, habit enables the performance of cognitive tasks without demanding cognitive capacity (Thøgersen 1995).

Second, TPB lacks the specific element of individual environmental considerations that have been shown to have direct and significant influence on intention to perform pro-circular behavior (Bamberg and Möser 2007). In this case, individual environmental considerations refer to personal norms that reflect one’s internalized values on environmental issues. Although SN may at first influence the intention to perform pro-circular behavior, the norm may be later internalized as part of personal norms that can influence behavioral intention. In research on environmentally related behaviors, it has also been found that when personal norm is controlled for, the relationship between SN and behavioral intention appears to be insignificant (Thøgersen 1995). Therefore, aside from ATB, SN, PBC, and habit, environmental awareness (EA) should be taken into account when examining pro-circular behaviors. This extension of TPB is illustrated in Figure 2.

As depicted in Figure 2, each factor has its own elements or subfactors. ATB, according to Fishbein and Ajzen (2011), can be constructed from imagined outcomes (the strength of a belief that performing the behavior will result in a certain outcome) and the evaluation of the imagined outcome. Meanwhile, SN can be composed from the normative beliefs of other people and the individual motivation to comply with those beliefs. Likewise, PBC is assumed to rely on the sum of the likelihood of the presence or availability of control factors that enable the performance of a behavior and its power (whether or not it can influence the decision to perform the behavior). Habit, which is defined as repeated and consistent behaviors (Verplanken and Holland 2002), may be displayed by the strength of current habit (in regard to its frequency) as well as habit direction (the willingness to change the current habit). By contrast, EA can be constructed from problem awareness and feelings of guilt over the consequences of individual behavior on the environment. All of these factors are predicted to have an influence on individual intention to perform a behavior, including pro-circular behaviors.

Based on the explanations above, the hypotheses of this study are proposed as follows:

H.1 Persuasive communication influences changes in ATB toward pro-circular behaviors
H.2 Persuasive communication influences changes in PCB toward pro-circular behaviors
H.3 Persuasive communication influences changes in SN toward pro-circular behaviors

![Figure 1. Theory of planned behavior. Source: Ajzen (1985).](image-url)
H.4 Persuasive communication influences changes in EA toward pro-circular behaviors
H.5 Persuasive communication influences changes in habits toward pro-circular behaviors
H.6 Persuasive communication influences changes in behavioral intention toward pro-circular behaviors

The inclusion of EA and habits into our model is also deemed necessary to address certain issues related to food waste, especially since participants in our study are the producers who will be directly involved in the implementation process for relevant circular economy procedures. Thus, factors, such as participants’ current waste-management practices, their willingness to change their current practices, presence of control factors that might influence the implementation process, their environmental awareness and feelings of guilt over the consequences of their action on the environment, and social pressures from customers and other restaurant and retail businesses should all be considered. Thus, while this study in general follows the P-CCM model framework of Muranko et al. (2019), there are differences in the components of the model as summarized in Table 1.

Circular business model
As this study aims to examine pro-circular behaviors among the managers of restaurants and food retailers, the operationalization of a circular business model (CBM) is also deemed necessary. In this respect, it is important to note that CBMs have different characteristics from linear business models (LBMs). According to Elzinga (2018), the differences between CBMs and LBMs relate to three particular aspects: ownership, responsibility, and budget structure. First, unlike LBMs in which there is a change in the ownership of a product (from seller to buyer), the ownership of a product in a CBM, including its waste, remains with the seller. Second, business responsibility in CBMs also differs from that LBMs as the former focuses on environmental, social, and financial value propositions while the latter is merely concerned with creating financial value without putting emphasis on the importance of sustainability. Finally, the adoption of CBMs leads to differences in budget structure which include both cost and revenue streams. In the case of the restaurant and retail sectors, for example, businesses that implement CBMs might have to incur extra costs to recycle food waste. However, adoption of a CBM
might create opportunities for additional revenue streams from food-waste composting and sales of organic fertilizer products or energy (i.e., biogas and electricity).

**Methods**

The data for this study were collected through an online self-assessment survey. The questions were based on the extended version of TPB, which includes ATB, SN, PBC, habits, EA, and behavioral intention. To examine the impact of persuasive communication on pro-circular behaviors, the survey was administered immediately before and after the intervention. Due to COVID-19-related social restrictions, a video intervention was delivered during a webinar on circular economy for the restaurant and retail sectors in August 2020. Although the data-collection process was conducted online, we developed several measures to ensure the robustness and consistency of the intervention. First, during the webinar, participants could only access and complete the survey during a short period of time in the given schedule (approximately 45 minutes). Second, the survey was administered just before and after participants were exposed to the video intervention.

Using this procedure, we managed to collect data from 55 business managers. According to Hogg and Tanis (2013), this sample size is sufficient for this type of analysis because it is greater than 30 respondents. The sample included individuals from the restaurant and retail sectors who hold strategic positions in the decision-making process such as owners, directors, managers, and supervisors. Accordingly, they had control over business practices including the waste-management system. Since data collection was conducted after some of the COVID-19 restrictions had been lifted and the restaurant and retail businesses could operate normally, we are confident that the results of the study were not significantly influenced by the pandemic.

**Research procedures**

This study was conducted in three consecutive stages. First, we carried out pre-intervention surveys to collect data on the initial perceptions of the webinar participants. Second, participants were exposed to a video intervention which delivered belief-targeting messages about circular economy practices in the restaurant and retail sectors. Finally, we asked participants to complete a post-intervention survey immediately after the intervention.

**Pre-intervention survey**

To ensure that the participants adequately understood the context of the study, the survey began with a brief introduction to the study followed by an informed consent form. After completing the form, they proceeded to answer several questions on demographic characteristics (e.g., age, gender, business role or position) and the characteristics of their business (e.g., monthly profit, number of employees). To accommodate varying responses in this section, we provided multiple-choice items with an open-ended option. Participants were then asked to answer questions on the subjective measures of each factor in the extended version of TPB (ATB, PBC, SN, habits, EA, and intention) using 7-point Likert scales.

**Behavioral change intervention design**

The behavioral change intervention (BCI) of this study was implemented via a ten-minute video. We

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**Table 1. Comparison of P-CCM context applied in Muranko et al. (2019) and in this study.**

| Components                | P-CCM applied in Muranko et al. (2019)                                                                 | P-CCM applied in this study                                                                 |
|---------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Attitude toward Behavior  | Participants’ attitude toward the purchase of remanufactured refrigeration equipment (e.g., good–bad, convenient–inconvenient, necessary–unnecessary) | Participants’ attitude toward the adoption of a circular economy model in their waste-management practices (e.g., good–bad, easy–hard, necessary–unnecessary, useful–useless) |
| Perceived Behavioral Control | (Unexplored in the study)                                                                                   | The presence of control factor over, for instance, the incurred costs of processing food waste, the availability of and access to waste-recycling infrastructures. (Unexplored in the study) |
| Product Perceptions       | Participants’ perception on the quality, performance, appearance, longevity, and warranty of remanufactured refrigeration equipment. (Unexplored in the study) | Participants’ perceived normative belief of their consumers and other restaurant and retail businesses in regard to the implementation of circular economy practices in waste-management system. |
| Subjective Norms          | (Unexplored in the study)                                                                                   | Participants’ environmental awareness and feelings of guilt over the consequences of their action on the environment. (Unexplored in the study) |
| Environmental Awareness   | (Unexplored in the study)                                                                                   | Participants’ current waste-management practice and their willingness to change their current model of waste-management system. (Unexplored in the study) |
| Habits                    | (Unexplored in the study)                                                                                   |                                                                                             |
| Behavioral Intention      | Participants’ intention to purchase remanufactured refrigeration equipment. (Unexplored in the study)       | Participants’ intention to adopt circular economy model in their waste-management practices. (Unexplored in the study) |
involved practitioners from the waste-management industry in the video-production process. The content of the video was also developed by considering the three key components of persuasive communication. According to Ajzen (1991), these factors include a recommended action that outlines a particular problem that calls for the performance of a specific behavior, an argument which provides reasoning for the adoption of the recommended action, and evidence of justification which can strengthen the argument.

The video began with an explanation about the urgency of food-waste problems in Indonesia. After highlighting the issue, we called for action to adopt a circular economy model in waste-management practices along with real-life examples from the restaurant and retail sectors. The video also featured pictures and graphic illustrations to depict the process. In addition, we made use of different sizes of fonts to communicate the tone of the messages. Finally, to strengthen our argument on the importance of circular economy adoption in waste-management practices, the video provided supporting data as well as findings from reports and previous studies.

To deliver persuasive messages, we selected to use video as the preferred medium of communication. According to a recent study by Oh et al. (2020), the use of persuasive 360-degree video can positively influence pro-circular behavior. A meta-analysis conducted by Shen et al. (2015) also indicated that narratives delivered via audio and video could generate more significant impacts compared to print-based forms. For example, people display higher intention to protect the environment after watching 360-degree videos regarding climate change (Oh et al. 2020). It is necessary to note that the message disseminated in the video should be developed based on relevant psychological theory and empirical evidence (Hamilton et al. 2018).

Post-intervention survey
To enable evaluation of the intervention, the post-intervention survey contained the same set of questions as the pre-intervention questionnaire.

Data analysis
The data were analyzed using descriptive and inferential statistical methods with the latter used to assess the impact of BCI on pro-circular behaviors among the study participants. Accordingly, we deployed a paired sample t-test to determine whether the average value of factors after the intervention significantly differed from the average value before the intervention. In addition, Pearson’s chi-square test was also used to determine the significance of differences in the distribution of the data before and after the intervention.

Results
In this section, first we present the differences in the study participants’ attitude before and after the intervention, based on the six hypotheses we developed earlier. Then, we discuss the effectiveness of persuasive communication in promoting pro-circular behaviors in the restaurant and retail food sectors based on the findings of each hypothesis.

Attitude toward behavior
The results presented on Table 2 show participants’ attitudes toward pro-circular behaviors in waste-management practices. With respect to the ownership aspect, although participants generally agreed

| Table 2. Attitude toward Behavior (ATB) before and after the intervention. |
|--------------------------|------------------|---|---|---|---|---|
| Ownership                |                 |   |   |   |   |   |
| Imagined outcomes before (good–bad) | 55 | 6.47 | 0.95 | 0.017 | 1 | 7 |
| Imagined outcomes after (good–bad) | 55 | 6.43 | 0.85 | 0.015 | 4 | 7 |
| Evaluation of outcomes before (necessary–unnecessary) | 55 | 3.38 | 1.82 | 0.033 | 1 | 7 |
| Evaluation of outcomes after (necessary–unnecessary) | 55 | 4 | 1.89 | 0.034 | 1 | 7 |
| Responsibility           |                 |   |   |   |   |   |
| Imagined outcomes before (beneficial–harmful) | 55 | 3.8 | 1.71 | 0.031 | 1 | 7 |
| Imagined outcomes after (beneficial–harmful) | 55 | 5.41 | 1.32 | 0.024 | 2 | 7 |
| Evaluation of outcomes before (easy–hard) | 55 | 2.54 | 1.54 | 0.028 | 1 | 7 |
| Evaluation of outcomes after (easy–hard) | 55 | 2.83 | 1.66 | 0.030 | 1 | 7 |
| Imagined outcomes (third party) before (useful–useless) | 55 | 6.14 | 1.17 | 0.021 | 2 | 7 |
| Imagined outcomes (third party) after (useful–useless) | 55 | 5.87 | 1.33 | 0.024 | 1 | 7 |
| Evaluation of outcomes (third party) before (convenient–inconvenient) | 55 | 3.5 | 1.85 | 0.034 | 1 | 7 |
| Evaluation of outcomes (third party) after (convenient–inconvenient) | 55 | 4.27 | 1.9 | 0.035 | 1 | 7 |
| Budget Structure         |                 |   |   |   |   |   |
| Imagined outcomes before (profitable–unprofitable) | 55 | 4.14 | 1.67 | 0.034 | 1 | 7 |
| Imagined outcomes after (profitable–unprofitable) | 55 | 4.54 | 1.76 | 0.032 | 1 | 7 |
| Evaluation of outcomes before (inexpensive–expensive) | 55 | 3.83 | 1.98 | 0.036 | 1 | 7 |
| Evaluation of outcomes after (inexpensive–expensive) | 55 | 3.45 | 2.12 | 0.039 | 1 | 7 |
that the adoption of a circular economy model is a worthwhile action (6.47), they perceived that its implementation in their waste-management system was unnecessary (3.38), with only a slight increase after the intervention (4.00). Regarding the aspect of responsibility, we recorded a positive increase in attitude toward a circular economy (from 3.80 to 5.41). We also found a small positive change in attitude toward circular economy being easy to adopt (from 2.54 to 2.83), although the number still suggests that participants perceived the implementation process to be relatively difficult. However, they did express positive attitudes toward the presence of a third party (i.e., a waste-management service) to help manage food waste.

Concerning budget structure, the participants’ attitude toward the implementation of a circular economy being profitable was relatively positive (4.41) with a slight increase recorded after the intervention (4.54). This result indicates that participants might perceive the existence of economic benefits from adopting circular economy practices in their waste-management system. However, their general view was that such procedures would involve extra costs that could potentially be expensive.

As depicted in the summary of the t-test on Table 4, statistically significant differences were found with respect to ownership and responsibility, but not in budget structure. This finding suggests that the intervention had a significant influence on changing participants’ attitude toward the adoption of circular economy procedures being necessary, beneficial, and convenient with the help of waste management-service providers.

### Perceived behavioral control

With regard to the ownership aspect, the presence of the control factor was found to be negative both before and after the intervention (see Table 4). In this case, participants might have thought that they had no control over the factors that might enable them to adopt a circular economy model in their waste-management system, such as the availability of and access to waste-recycling infrastructures. Interestingly, in scenarios where they could access services from a waste-management provider, the presence and power of the control factor were positive, both before and after the intervention. This finding suggests that the availability of waste management-service providers might play an important role in promoting pro-circular behaviors in Surabaya’s restaurant and business sectors. With respect to the budget structure, a positive change was recorded in participants’ perceived control over a circular economy model being financially feasible to implement (from 4.09 to 4.78). This result indicates that it might be possible for them to allocate

#### Table 3. The t-test on Attitude toward Behavior (ATB) before and after the intervention.

| Ownership | Diff. | df  | p    |
|-----------|-------|-----|------|
| Imagined outcomes (good–bad) | 0.16 | 105 | 0.042* |
| Evaluation of outcomes (necessary–unnecessary) | 0.618 | 105 | 0.042* |
| Responsibility | | | |
| Imagined outcomes (beneficial–harmful) | 1.61 | 105 | 0.000* |
| Evaluation of outcomes (easy–hard) | 0.29 | 105 | 0.172 |
| Imagined outcomes (useful–useless) | −0.272 | 105 | 0.129 |
| Evaluation of outcomes (third party) (convenient–inconvenient) | −0.768 | 105 | 0.018* |
| Budget Structure | | | |
| Imagined outcomes (profitable–unprofitable) | 0.4 | 105 | 0.125 |
| Evaluation of outcomes (inexpensive–expensive) | −0.38 | 105 | 0.166 |

Hypothesis: before < after; Significance: p < 0.1.*

#### Table 4. Perceived Behavioral Control (PBC) before and after the intervention.

| Ownership | N | x | SD | SE | min | max |
|-----------|---|---|----|----|-----|-----|
| Presence of control factor before (complete control–no control) | SS | 2.63 | 1.5 | 0.027 | 1 | 7 |
| Presence of control factor after (influential–not influential) | SS | 2.09 | 1.09 | 0.020 | 1 | 7 |
| Power of control factor before (influential–not influential) | SS | 2 | 1.05 | 0.019 | 1 | 7 |

| Responsibility | N | x | SD | SE | min | max |
|----------------|---|---|----|----|-----|-----|
| Presence of control factor (third party) before (no effort–a lot of efforts) | SS | 6.29 | 0.87 | 0.016 | 4 | 7 |
| Power of control factor (third party) before (influential–not influential) | SS | 6.2 | 1.11 | 0.020 | 2 | 7 |
| Power of control factor (third party) after (influential–not influential) | SS | 5.12 | 1.24 | 0.023 | 1 | 7 |

| Budget Structure | N | x | SD | SE | min | max |
|------------------|---|---|----|----|-----|-----|
| Presence of control factor before (possible–impossible) | SS | 4.09 | 1.61 | 0.029 | 1 | 7 |
| Power of control factor after (possible–impossible) | SS | 4.78 | 1.46 | 0.027 | 2 | 7 |
| Power of control factor before (influential–not influential) | SS | 5.01 | 1.86 | 0.034 | 1 | 7 |
| Power of control factor after (influential–not influential) | SS | 5.83 | 1.24 | 0.023 | 2 | 7 |
extra financial resources for the implementation of circular economy adoption. The availability of this particular control factor also appears to influence their decision to embrace the model.

As for the results of t-test in Table 5, a statistically significant difference was recorded in the presence of the control factor in the ownership aspect. This result indicates that the intervention significantly changed participants’ perceived control, albeit the fact that they still believed they had no control over the factors that might enable them to implement circular economy practices (from 2.63 to 3.30). By contrast, with respect to budget structure, the intervention appears to have significantly affected participants’ perceived control over a circular economy model being financially conceivable to adopt in their waste-management practices. There is also a statistically significant effect recorded in terms of the power of this particular control factor after the intervention, suggesting that participants’ perceived financial capabilities greatly influence decisions on whether or not they would adopt a circular economy model in their waste-management system.

**Subjective norms**

Prior to the intervention, participants generally believed that the adoption of a circular economy model in their waste-management practices was not very common within the restaurant and retail sectors (see Table 6). However, they signaled a strong willingness to adopt the practice if other restaurant and retail businesses also implemented the same system.

The t-test results reported in Table 7 show that the intervention significantly made participants more aware of the fact that many businesses have implemented the practice, but we found no statistically significant difference in their motivation to comply and adopt the model. This might be due to the fact that their motivation to comply was already positive at the start.

**Environmental awareness**

According to the results in Table 8, participants’ environmental awareness was highly positive, even before they were exposed to the intervention. Not only were they aware of the prevalence of food-waste problems, they were also attentive to the fact that their actions may adversely affect the environment. This finding might also explain why their feelings of guilt over the consequences of their behaviors on the environment were high.

Results in Table 9 show that a statistically significant difference was only recorded for participants’ awareness of environmental issues. While this finding indicates that the intervention notably increased their awareness of environmental problems, no statistically significant difference was found in their feelings of guilt.

**Habit**

With respect to habit, we found that even before the intervention participants expressed a willingness to
change their current practice of waste management and to adopt a circular economy model (see Table 10). This finding might then explain why there is no statistically significant difference found after the intervention (see Table 11).

**Behavioral intention**

Prior to the intervention, participants’ intention to adopt a circular economy model in their waste-management practices was negative (see Table 12). Even afterward, no statistically significant difference was found in their behavioral intention (see Table 13). This finding suggests that the intervention might not be effective in influencing participants’ intention to adopt pro-circular behaviors.

To further investigate the strength of our results, we also conducted a robustness test using a bootstrapping method with 10,000 iterations. The test showed that all the results were consistent. The output of the robustness test is presented in Appendix A.

**Discussion**

We overall found that persuasive communication can have a statistically significant effect on influencing participants’ attitudes toward pro-circular behaviors, their perceived behavioral control, and their awareness of environmental issues. Our finding with respect to the positive impact of persuasive communication on pro-circular attitudes is aligned with the result reported by Muranko et al. (2019). In addition, our analysis revealed a number of other interesting results. First, despite participants’ awareness of food-waste problems and their positive attitudes toward environmentally friendly waste-management practices, they were apparently not inclined to adopt a circular economy model in their waste-management system. In this case, the absence of perceived social pressures might explain the lack of intention. This gap between attitude and behavioral intention is aligned with a number of previous studies including Ajzen and Fishbein (1980), Blake (1999), and Mostaghel and Chirumalla (2021). According to these authors, individuals’ intentions are not solely influenced by their attitudes, but are also impelled by social pressures that, in the case of this study, should have come from consumer pressure and peer influence from others in the restaurant and retail business sectors. However, green purchasing behavior among Indonesian consumers is not common and there is a low level of public environmental awareness in the country (Parker 2018). The absence of perceived social pressures can additionally be attributed to the fact that food-waste issues are rarely raised and discussed in meetings of business associations for the restaurant and retail sectors in Indonesia. Under these circumstances, owners and managers generally experience less pressure to adopt circular economy practices. Information pertaining to promotion, problem awareness, and knowledge about solutions are crucial for raising producers’ pro-circular behavior (Garcés-Ayerbe et al. 2019; Sijtsma et al. 2019). Therefore, our findings generally support the notion that, while increasing environmental awareness is necessary, it is not a sufficient precondition for the adoption of circular economy practices on the part of the restaurants and food retailers.

In addition to the absence of social pressures, our results also suggest that the gap in intention might be explained by the practicality of adopting circular economy strategies. This observation also helps to explain why our respondents generally perceived the role of waste management-service providers as useful. This finding corresponds with Blake (1999) and Akkalatham and Taghipour (2021) who reported that practical constraints often prevent individuals from acting pro-environmentally regardless of their positive attitudes toward environmental issues. These practical constraints might be associated with both internal and external factors. In the case of our study, the internal factors include the lack of technical capacity to adopt circular economy practices and the external factors involve the general lack of availability of accessible waste-recycling

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**Table 10.** Habits before and after the intervention.

| Habit strength before | N  | x  | SD | SE  | min | max |
|-----------------------|----|----|----|-----|-----|-----|
| Habit strength after  | 55 | 5.65 | 1.26 | 0.023 | 2 | 7 |
| Habit direction before| 55 | 6.2 | 1 | 0.018 | 4 | 7 |
| Habit direction after | 55 | 6.01 | 1.2 | 0.022 | 1 | 7 |

**Table 11.** The t-test on habits before and after the intervention.

|                    | Diff. | df | p   |
|--------------------|-------|----|-----|
| Habit strength     | 0.109 | 108| 0.325|
| Habit direction    | -0.18 | 108| 0.196|

Hypothesis: before < after; Significance: p < 0.1.

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**Table 12.** Behavioral intention before and after the intervention.

| Intention before | N  | x  | SD | SE  | min | max |
|------------------|----|----|----|-----|-----|-----|
| Intention after  | 55 | 2.54 | 1.54 | 0.028 | 1 | 7 |

**Table 13.** The t-test on behavioral intention before and after the intervention.

| Intention | diff | df | p   |
|-----------|------|----|-----|
| Intention | 0.29 | 108| 0.172|

Hypothesis: before < after; Significance: p < 0.1.
infrastructure and supporting public policies. Correspondingly, these practical constraints might also explain the absence of a control factor in the ownership aspect which led respondents to believe that they had no control to implement circular economy practices. However, it is necessary to note that with respect to budget structure, the intervention appeared to significantly and positively affect participants’ perceived control over their financial capabilities. Although they lack technical capacity to adopt a circular economy model in their waste-management system, they have the monetary wherewithal to do so. Accordingly, the availability of waste management-service providers could likely play a crucial role in promoting pro-circular behaviors within the restaurant and retail food sectors.

Conclusion

This study aimed to examine the influence of persuasive communication in promoting pro-circular behaviors in the restaurant and retail food sectors by employing P-CCM using the extended version of TPB. We found that despite being aware of the need to address the food-waste problem, our study participants were not inclined to adopt a circular economy model in their waste-management system. The absence of perceived social pressures and the presence of practical constraints likely explains their lack of intention to implement relevant business strategies. However, participants in the project did express positive views about the role that waste management-service providers could play in helping them to more effectively manage their food waste. We also found that persuasive communication can be effective in changing people’s perceived control over a circular economy model being financially possible to adopt. This study further showed that persuasive communication can be useful in promoting pro-circular behaviors within certain business sectors, considering its significant and positive influence on individuals’ attitudes, perceived behavioral control, and awareness of environmental issues. On the basis of these promising results, we encourage further research on this type of intervention in other business sectors.

The findings of this study also have a number of important implications for public policy. First, we have shown that business actors in the restaurant and retail sectors tend to conduct themselves like economic agents who are primarily motivated by economic incentives. Accordingly, the use of economic incentives could generate actual behavioral change, at least in the short term. At the same time, public policy could over the longer term seek to raise the environmental awareness of consumers as they appear to have an influence by creating market pressure. Apart from the consumer side, our results also suggest that peer pressure might play an important role in promoting pro-environmental behaviors and therefore there is a need for business associations to take a more active interest in such matters.1 Future studies may examine the role of intermediation in encouraging action on circular economy initiatives in developing country settings.

Note

1. See, in particular, Rainville (2021), Kanda et al. (2019), and Patala, Salmi, and Bocken (2020) which found that intermediaries play a critical role in promoting a more circular economy in the case of developed countries.

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Ethical standard

Ethics approval for this study was obtained from the Health Research Ethics Committee, Faculty of Nursing, Universitas Airlangga on August 11, 2020. The ethical approval number is 2098-KEPK.

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ORCID

Ilmiawan Auwalin http://orcid.org/0000-0003-1520-1190
Rumayya http://orcid.org/0000-0001-8216-3628

References

Ajzen, I. 2006. “Constructing a Theory of Planned Behavior Questionnaire.” http://people.umass.edu/aizen/pdf/tpb.measurement.pdf

Ajzen, I. 1985. “From Intentions to Actions: A Theory of Planned Behavior.” In Action Control, edited by J. Kuhl and J. Beckmann, 1–39. Heidelberg: Springer-Verlag. doi:10.1007/978-3-642-69746-3_2.
Ajzen, I. 1991. “The Theory of Planned Behavior.” Organizational Behavior and Human Decision Processes 50 (2): 179–211. doi:10.1016/0749-5978(91)90020-T.

Ajzen, I. 2011. “The Theory of Planned Behaviour: Reactions and Reflections.” Psychology & Health 26 (9): 1113–1127. doi:10.1080/08870446.2011.613995.

Ajzen, I., and M. Fishbein. 1980. Understanding Attitudes and Predicting Social Behavior. Englewood Cliffs, NJ: Prentice-Hall.

Akalatham, W., and A. Taghipour. 2021. “Pro-environmental Behavior Model Creating Circular Economy in Steel Recycling Market, Empirical Study in Thailand.” Environmental Challenges 4: 100112. doi:10.1016/j.envc.2021.100112.

Amir, E., S. Hophmayer-Tokich, and T. Kurnani. 2015. “Socio-Economic Considerations of Converting Food Waste into Biogas on a Household Level in Indonesia: The Case of the City of Bandung.” Recycling 1 (1): 61–88. doi:10.3390/recycling1010061.

Andriani, D. 2016. A Glance at the World: Current Status of Waste Management in Indonesia. Bandung: Indonesia Institute of Sciences.

Andriani, D., and T. Atmaja. 2019. “The Potentials of Landfill Gas Production: A Review on Municipal Solid Waste Management in Indonesia.” Journal of Material Cycles and Waste Management 21 (6): 1572–1586. doi:10.1007/s10163-019-00895-5.

Aranda-Usón, A., P. Portillo-Tarragona, S. Scarpellini, and F. Llena-Macarulla. 2020. “The Progressive Adoption of a Circular Economy by Businesses for Cleaner Production: An Approach from a Regional Study in Spain.” Journal of Cleaner Production 247: 119648. doi:10.1016/j.jclepro.2019.119648.

Badhotiya, G., S. Avikal, G. Soni, and N. Sengar. 2021. “Analyzing Barriers for the Adoption of Circular Economy in the Manufacturing Sector.” International Journal of Productivity and Performance Management. published online June 3: 1–20. doi:10.1108/IJPPM-01-2021-0021.

Bajželj, B., T. Quested, E. Röös, and R. Swannell. 2020. “The Role of Reducing Food Waste for Resilient Food Systems.” Ecosystem Services 45: 101140. doi:10.1016/j.ecoser.2020.101140.

Bamberg, S., and G. Möser. 2007. “Twenty Years after Hines, Hungerford, and Tomera: A New Meta-Analysis of Psycho-Social Determinants of Pro-environmental Behaviour.” Journal of Environmental Psychology 27 (1): 14–23. doi:10.1016/j.jenvp.2006.12.002.

Blake, J. 1999. “Overcoming the ‘Value-Action Gap’ in Environmental Policy: Tensions Between National Policy and Local Experience.” Local Environment 4 (3): 257–278. doi:10.1080/13549839908725599.

Borrello, M., F. Caracciolo, A. Lombardi, S. Pascucci, and L. Cembalo. 2017. “Consumers’ Perspective on Circular Economy Strategy for Reducing Food Waste.” Sustainability 9 (1): 141. doi:10.3390/su9010141.

Borrello, M., S. Pascucci, F. Caracciolo, A. Lombardi, and L. Cembalo. 2020. “Consumers Are Willing to Participate in Circular Business Models: A Practice Theory Perspective to Food Provisioning.” Journal of Cleaner Production 259: 121013. doi:10.1016/j.jclepro.2020.121013.

Botetzagias, I., A. Dima, and C. Malesios. 2015. “Extending the Theory of Planned Behavior in the Context of Recycling: The Role of Moral Norms and of Demographic Predictors.” Resources, Conservation and Recycling 95 (1): 58–67. doi:10.1016/j.resconrec.2014.12.004.

Chen, M., and P. Tung. 2010. “The Moderating Effect of Perceived Lack of Facilities on Consumers’ Recycling Intentions.” Environment and Behavior 42 (6): 824–844. doi:10.1177/0013916509352833.

Cicatiello, C., S. Franco, B. Pancino, and E. Blasi. 2016. “The Value of Food Waste: An Exploratory Study on Retailing.” Journal of Retailing and Consumer Services 30 (1): 96–104. doi:10.1016/j.jretconserv.2016.01.004.

Damanhuri, E., W. Handoko, and T. Padmi. 2014. “Municipal Solid Waste Management in Indonesia.” In Municipal Solid Waste Management in Asia and the Pacific Islands: Environmental Science and Engineering, edited by A. Pariatambmy and M. Tanaka. 139–155. Singapore: Springer.

Daryanto, A., and Sahara. 2016. “Food Loss in Supermarkets: What Can Supermarkets Do to Reduce Food Loss?” Proceedings of the Crawford Fund 2016 Annual Conference, 75–88. doi:10.22004/ag.econ.257228.

Davis, G., P. Phillips, A. Read, and Y. Iida. 2006. “Demonstrating the Need for the Development of Internal Research Capacity: Understanding Recycling Participation Using the Theory of Planned Behaviour in West Oxfordshire, UK.” Resources, Conservation and Recycling 46 (2): 115–127. doi:10.1016/j.resconrec.2005.07.001.

Dhokhikah, Y., Y. Trihadiningrum, and S. Sunaryo. 2015. “Community Participation in Household Solid Waste Reduction in Surabaya, Indonesia.” Resources, Conservation and Recycling 102 (1): 153–162. doi:10.1016/j.resconrec.2015.06.013.

Dora, M. 2019. “Collaboration in a Circular Economy: Learning from the Farmers to Reduce Food Waste.” Journal of Enterprise Information Management 33 (4): 769–789. doi:10.1108/JEIM-02-2019-0062.

Ellen MacArthur Foundation (EMF). 2019. Cities and Circular Economy for Food. London: Ellen MacArthur Foundation.

Elzinga, R. 2018. “Consumer Behaviour in a Circular Economy: Testing Consumer Willingness to Participate in Circular Business Models,” Master’s Thesis, Utrecht University.

Fajfrl, Z., M. Přikrylová, P., A. Brunerová, and H. Roubík. 2020. “Analyses of Waste Treatment in Rural Areas of East Java with the Possibility of Low-Pressure Briquetting Press Application.” Sustainability 12 (19): 8153. doi:10.3390/su12198153.

Fassio, F., and B. Minotti. 2019. “Circular Economy for Food Policy: The Case of the RePoPP Project in the City of Turin (Italy).” Sustainability 11 (21): 6078. doi:10.3390/su11216078.

Fishbein, M., and I. Ajzen. 2011. Predicting and Changing Behavior: The Reasoned Action Approach. New York: Psychology Press.

Fonseca, L., J. Domingues, M. Pereira, F. Martins, and D. Zimon. 2018. “Assessment of Circular Economy within Portuguese Organizations.” Sustainability 10 (7): 2521. doi:10.3390/su10072521.

Food and Agriculture Organization (FAO). 2019. The State of Food and Agriculture: Moving Forward on Food Loss and Waste Reduction. Rome: FAO.

Fox, D., E. Ioannidi, Y.-T. Sun, V. Jape, W. Bawono, S. Zhang, and F. Perez-Cueto. 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: 49–54. doi:10.1016/j.jgifs.2017.11.005.

Garcés-Ayerbe, C., P. Rivera-Torres, I. Suárez-Perales, and D. Leyva-de la Hiz. 2019. “Is It Possible to Change from a Linear to a Circular Economy? An Overview of Opportunities and Barriers for European Small and Medium-Sized Enterprise Companies.” International Journal of Environmental Research and Public Health 16 (5): 851. doi:10.3390/ijerph16050851.

Gardner, B., G. de Bruijn, and P. Lally. 2011. “A Systematic Review and Meta-Analysis of Applications of the Self-Report Habit Index to Nutrition and Physical Activity Behaviours.” Annals of Behavioral Medicine 42 (2): 174–187. doi:10.1007/s12160-011-9282-0.

Geiger, J., L. Steg, E. van der Werff, and A. Ünal. 2019. “A Meta-Analysis of Factors Related to Recycling.” Journal of Environmental Psychology 64 (1): 78–97. doi:10.1016/j.jenvp.2019.05.004.

Govindan, K., and M. Hasanagic. 2018. “A Systematic Review on Drivers, Barriers, and Practices towards Circular Economy: A Supply Chain Perspective.” International Journal of Production Research 56 (1–2): 278–311. doi:10.1080/00207543.2017.1402141.

Hamilton, K., A. E. Peden, J. J. Keech, and M. S. Hagger. 2018. “Changing People’s Attitudes and Beliefs toward Driving through Floodwaters: Evaluation of a Video Infographic.” Transportation Research Part F: Traffic Psychology and Behaviour 53: 50–60. doi:10.1016/j.trf.2017.12.012.

Hardehan, W., M. Johnston, D. Johnston, D. Bonetti, N. Wardham, and A. Kinmonth. 2002. “Application of the Theory of Planned Behaviour in Behaviour Change Interventions: A Systematic Review.” Psychology & Health 17 (2): 123–158. doi:10.1080/08874042900136444.

Hogg, R., and E. Tanis. 2013. Probability and Statistical Inference. 9th ed. London: Pearson.

Huber, M., and L. Hilty. 2015. “Gamification and Sustainable Consumption: Overcoming the Limitations of Persuasive Technologies.” In ICT Innovations for Sustainability, edited by L. Hilty and B. Aebischer, 367–385. Cham: Springer.

Kanda, W., P. del Rio, O. Hjelm, and D. Bienkowska. 2019. “A Technological Innovation Systems Approach to Analyse the Roles of Intermediaries in Eco-Innovation.” Journal of Cleaner Production 227: 1136–1148. doi:10.1016/j.jclepro.2019.04.230.

Khan, O., T. Daddi, H. Slabbincx, K. Kleinhans, D. Vazquez-Bust, and S. De Meester. 2020. “Assessing the Determinants of Intentions and Behaviors of Organizations Towards a Circular Economy for Plastics.” Resources, Conservation and Recycling 163: doi:10.1016/j.resconrec.2020.105069.

Kristanto, G., and W. Koven. 2019. “Estimating Greenhouse Gas Emissions from Municipal Solid Waste Management in Depok, Indonesia.” City and Environment Interactions 4 (1): 100027. doi:10.1016/j.caci.2020.100027.

Lehtokunnas, T. M., Mattila, E. Närvänä, and N. Mesiranta. 2020. “Towards a Circular Economy in Food Consumption: Food Waste Reduction Practices as Ethical Work.” Journal of Consumer Culture. Published online June 6: 1–19. doi:10.1177/1469540520926252.

Lieder, M., and A. Rashid. 2016. “Towards Circular Economy Implementation: A Comprehensive Review in Context of Manufacturing Industry.” Journal of Cleaner Production 115: 36–51. doi:10.1016/j.jclepro.2015.12.042.

Liu, Y., and Y. Bai. 2014. “An Exploration of Firms’ Awareness and Behavior of Developing Circular Economy: An Empirical Research in China.” Resources, Conservation and Recycling 87 (1): 145–152. doi:10.1016/j.resconrec.2014.04.002.

Meidiana, C., and T. Gamse. 2011. “The New Waste Law: Challenging Opportunity for Future Landfill Operation in Indonesia.” Waste Management & Research 29 (1): 20–29. doi:10.1177/0734242X10384013.

Melikoglu, M., C. Lin, and C. Webb. 2013. “Analysing Global Food Waste Problem: Pinpointing the Facts and Estimating the Energy Content.” Central European Journal of Engineering 3 (2): 157–164. doi:10.2478/s13531-012-0058-5.

Melles, G. 2021. “Figuring the Transition from Circular Economy to Circular Society in Australia.” Sustainability 13 (19): 10601. doi:10.3390/su131910601.

Mena, C., B. Adenso-Diaz, and O. Yurt. 2011. “The Causes of Food Waste in the Supplier-Retailer Interface: Evidences from the UK and Spain.” Resources, Conservation and Recycling 55 (6): 648–658. doi:10.1016/j.resconrec.2010.09.006.

Mostaghal, R., and K. Chirumalla. 2021. “Role of Customers on Circular Business Models.” Journal of Business Research 127 (1): 35–44. doi:10.1016/j.jbusres.2020.12.053.

Munawar, E., Y. Yunardi, J. Lederer, and J. Fellner. 2018. “The Development of Landfill Operation and Management in Indonesia.” Journal of Material Cycles and Waste Management 20 (2): 1128–1142. doi:10.1007/s10163-017-0676-3.

Munesue, Y., and T. Masui. 2019. “The Impacts of Japanese Food Losses and Food Waste on Global Natural Resources and Greenhouse Gas Emissions.” Journal of Industrial Ecology 23 (5): 1196–1210. doi:10.1111/jiec.12863.

Muranko, Z., D. Andrews, E. Newton, I. Chaer, and P. Proudman. 2018. “The Pro-circular Change Model (P-CCM): Proposing a Framework Facilitating Behavioural Change Towards a Circular Economy.” Resources, Conservation and Recycling 135 (1): 132–140. doi:10.1016/j.resconrec.2017.12.017.

Muranko, Z., D. Andrews, I. Chaer, and E. Newton. 2019. “Circular Economy and Behaviour Change: Using Persuasive Communication to Encourage Pro-circular Behaviours towards the Purchase of Remanufactured Refrigeration Equipment.” Journal of Cleaner Production 222: 499–510. doi:10.1016/j.jclepro.2019.02.219.

National Development Planning Agency (Bappenas). 2021. Food Loss and Waste in Indonesia Supporting the Implementation of Circular Economy and Low Carbon Development. Jakarta: National Development Planning Agency (Bappenas).

Oh, J., S. Sudarshan, E. Jin, S. Nah, and N. Yu. 2020. “How 360-Degree Video Influences Content Perceptions and Environmental Behavior: The Moderating Effect of Environmental Self-Efficacy.” Science Communication 42 (4): 423–453. doi:10.1177/1075547020932174.

Palm, E., L. Nilsson, and M. Åhman. 2016. “Electricity-Based Plastics and Their Potential Demand for Electricity and Carbon Dioxide.” Journal of Cleaner...
Purba, H., C. Meidiana, and D. Adrianto. 2014. “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): 012121. doi:10.1088/1755-1315/399/1/012121.

Pan, S., M. Du, I. Huang, I. Liu, E. Chang, and P. Chiang. 2015. “Strategies on Implementation of Waste-To-Energy (WTE) Supply Chain for Circular Economy System: A Review.” Journal of Cleaner Production 108: 409–421. doi:10.1016/j.jclepro.2015.06.124.

Parker, L. 2018. “Environmentalism and Education for Sustainability in Indonesia.” Indonesia and the Malay World 46 (136): 235–240. doi:10.1080/13639811.2018.1519994.

Patala, S., A. Salmi, and N. Bocken. 2020. “Intermediation Dilemmas in Facilitated Industrial Symbiosis.” Journal of Cleaner Production 261: 121093. doi:10.1016/j.jclepro.2020.121093.

Pamela, N., M. Aritonang, and J. Hutajulu. 2019. “Application of Analytic Hierarchy Process in a Circular Economy.” Waste Management 113: 359–368. doi:10.1016/j.wasman.2020.06.012.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Principato, L., L. Ruini, M. Guidi, and L. Secondi. 2019. “Adopting the Circular Economy Approach on Food Loss and Waste: The Case of Italian Pasta Production.” Resources, Conservation and Recycling 144: 82–89. doi: 10.1016/j.resconrec.2019.01.025.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Principato, L., L. Ruini, M. Guidi, and L. Secondi. 2019. “Adopting the Circular Economy Approach on Food Loss and Waste: The Case of Italian Pasta Production.” Resources, Conservation and Recycling 144: 82–89. doi: 10.1016/j.resconrec.2019.01.025.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.

Purba, H., C. Meidiana, and D. Adrianto. 2014. “Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia.” International Journal of Environmental Science and Development 5 (2): 212–216. doi:10.7763/IJESD.2014.V5.480.
van Lenthe, F., S. Kremers, and J. Brug. 2008. “Exploring Environmental Determinants of Physical Activity – The Road to the Future is Always Under Construction.” Public Health 122 (3): 329–329. doi:10.1016/j.puhe.2007.06.006.

Verplanken, B., and R. Holland. 2002. “Motivated Decision Making: Effects of Activation and Self-Centrality of Values on Choices and Behavior.” Journal of Personality and Social Psychology 82 (3): 434–447. doi:10.1037/0022-3514.82.3.434.

Vilariño, M., C. Franco, and C. Quarrington. 2017. “Food Loss and Waste Reduction as an Integral Part of a Circular Economy.” Frontiers in Environmental Science 5: 21. doi:10.3389/fenvs.2017.00021.

Wardhani, B., and V. Dugis. 2020. “Greening Surabaya: The City’s Role in Shaping Environmental Diplomacy.” Bandung 7 (2): 236–258. doi:10.1163/21983534-00702005.

Wibisono, H., F. Firdausi, and M. Kusuma. 2020. “Municipal Solid Waste Management in Small and Metropolitan Cities in Indonesia: A Review of Surabaya and Mojokerto.” IOP Conference Series: Earth and Environmental Science 447 (1): 012050. doi:10.1088/1755-1315/447/1/012050.

Zahara, Z., Muslimin, S. Hadi, and G. Vesakha. 2019. “How to Reduce Food Waste at Small Restaurant in Indonesia?” International Journal of Recent Technology and Engineering 8 (2S): 481–488.

Appendix A. Results of robustness tests

Table A.1. The results of robustness test on Attitude toward Behavior (ATB).

| Ownership               | t   | se  | p    | t   | se  | p    |
|------------------------|-----|-----|------|-----|-----|------|
| Imagined outcomes      | 0.2098 | 0.1733 | 0.417 | 0.24 | 1.13 | 0.833 |
| Evaluation of outcomes | 1.744 | 0.354 | 0.042 | 2.002 | 1.06 | 0.06 |
| Responsibility         | 5.53 | 0.292 | 0.000 | 6.41 | 0.875 | 0.000 |
| Evaluation of outcomes | 0.94 | 0.306 | 0.172 | 1.22 | 1.02 | 0.232 |
| Imagined outcomes      | 1.13 | 0.239 | 0.129 | 1.217 | 1.02 | 0.233 |
| Evaluation of outcomes | 2.13 | 0.358 | 0.018 | 2.94 | 0.85 | 0.001 |
| Structure Budget       | 1.15 | 0.346 | 0.125 | 1.71 | 1.07 | 0.112 |
| Evaluation of outcomes | 0.97 | 0.392 | 0.166 | 1.24 | 1.01 | 0.221 |

Table A.2. The results of robustness test on Perceived Behavioral Control (PCB).

| Ownership               | t   | se  | p    | t   | se  | p    |
|------------------------|-----|-----|------|-----|-----|------|
| Presence of control factor | 2.12 | 0.315 | 0.017 | 2.566 | 1.07 | 0.017 |
| Power of control factor  | 0.443 | 0.204 | 0.329 | 0.62 | 0.99 | 0.527 |
| Responsibility          | 0.000 | 0.176 | 1 | 0 | 1.03 | 1.00 |
| Power of control factor  | 0.322 | 0.22 | 0.3738 | 0.4 | 1 | 0.68 |
| Structure Budget        | 2.35 | 0.293 | 0.01 | 2.97 | 1.05 | 0.005 |
| Power of control factor  | 2.711 | 0.301 | 0.003 | 3.18 | 0.9 | 0.000 |
### Table A.3. The results of robustness test on Subjective Norms (SN).

|                      | Robustness |
|----------------------|------------|
|                      | t  | se  | p   | t  | se  | p   |
| Normative beliefs    | 1.29| 0.322| 0.098| 1.479| 1.01| 0.146|
| Motivation to comply | 0.000| 0.187| 1 | 0 | 1.02 | 1.0000 |

### Table A.4. The results of robustness test on Environmental Awareness (EA).

|                      | Robustness |
|----------------------|------------|
|                      | t  | se  | p   | t  | se  | p   |
| Problem awareness    | 2.49| 0.167| 0.007| 3.11| 0.905| 0.001|
| Feelings of guilt    | 0.306| 0.178| 0.379| 0.41| 1.06| 0.697|

### Table A.5. The Results of Robustness Test on Habits.

|                      | Robustness |
|----------------------|------------|
|                      | t  | se  | p   | t  | se  | p   |
| Habit strength       | 0.45| 0.24 | 0.325| 0.64| 1.12| 0.53 |
| Habit direction      | 0.856| 0.212| 0.196| 1.2 | 0.92| 0.195|

### Table A.6. The results of robustness test on behavioral intention.

|                      | Robustness |
|----------------------|------------|
|                      | t  | se  | p   | t  | se  | p   |
| Intention            | 0.94| 0.306| 0.172| 1.22| 1.02| 0.232|