The Role of Pro-Environmental Behavior in Adopting Household Waste Management System

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ABSTRACT

This research aims to analyze the adoption of waste management system technology, which is influenced by intentions, incentives, pro-environmental behavior, and empowerment. This research was conducted on community members in the Special Region of Yogyakarta, Indonesia, represented by each family member. Data was collected from 230 respondents currently having problems with increasingly piling up waste. The closure of rubbish dumps due to the large amount of rubbish causes the community to adopt environmentally friendly behavior. This research uses Partial Least Square to analyze the adoption of a waste management system. Some of the instruments used in this research were invalid, so four instruments were removed from the analysis model. The results of this research indicate that incentives and empowerment significantly influence the intention to adopt a waste management system. Pro-environmental behavior does not directly affect intention but has a significant effect on adopting a waste management system in the household.

Keywords: Incentives, empowerment, intention, and waste management system.

1. INTRODUCTION

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Environmental problems have threatened life in many countries. One of the factors that causes most of global warming besides environmental degradation is waste generation (Tan et al., 2021). Effective waste management is positioned as a sustainable solution to reduce and combat the negative impacts of climate change. Countries worldwide struggle to improve household waste management (Azevedo et al., 2021). The pressure of large amounts of uncontrolled waste accumulation has caused household waste sorting behavior to receive significant attention (Li & Wang, 2021). Many countries still struggle with Waste management systems (Campitelli & Schebek, 2020). Waste has become one of the most severe problems in Indonesia's urban areas (Sekarningrum et al., 2020). Waste is a crucial issue in an environment whose poor management can affect socioeconomic, health, and environmental problems. (Cao et al., 2021). Accumulating piles of waste urges all parties to develop waste management that encourages community behavior to sort and produce waste into organic fertilizer and recycling.

This study analyzes a mechanism model determining the critical factors in consumers' adoption of new waste management systems. Axsen et al. (2012) define pro-environmental technology as "any technology that consumers can perceive as having pro-environmental attributes" (p. 64). Pro-environmental behavior benefits the environment, such as recycling and minimizing waste production. In two studies, Kim et al. (2020) found that consumers preferred using technology in household waste reduction campaigns. Therefore, consumers are willing to use and adopt technological devices in the context of pro-environmental actions. Manika et al. (2021) emphasize the importance of analyzing actual technology adoption behavior in future research. This research aims to analyze factors that are important for technology adoption and waste sorting behavior: empowerment theory (Naranjo-Zolotov et al., 2019), financial and economic incentives (Botetzagias et al., 2020; Taleb & Al Farooque, 2021), and pro-environmental behavior (PEB) (Pierini et al., 2021; Steg, 2016). Empowerment is a process by which organizations and people gain competence on specific issues. The level of community involvement is an essential motivator for consumers to adopt recycling behavior schemes (Xevgenos et al., 2015). Park (2018), Skumatz (2008), and Taleb & Al Farooque (2021) show that incentives can increase people's intentions to carry out pro-environmental behavior, such as using PET, behaving in an environmentally friendly manner, and being willing to carry out waste processing. Further investigation into how and when financial incentives encourage sustained behavior is critical (Maki et al., 2016). This research analyzes two general approaches to incentives: pay as you throw (PAYT) and keep as you throw (SAYT). PAYT is a system where every citizen must contribute economically to the overall cost of services based on the amount of waste they dispose of (Wang et al., 2021). For example, users are charged based on how much unsorted waste their household produces. An alternative approach to pay-as-you-throw (PAYT) is to provide rewards, called save-as-you-throw (SAYT) – users are rewarded based on how well they sort household waste.

This research is an adoption of research conducted by Vorobeva et al. (2022) by taking samples from communities in Indonesia, especially in Yogyakarta. This research is also based on the theory of empowerment and environmental incentives. The role of PEB is also analyzed in system adoption. Combining several research variables is essential to identify the adoption of a new system in the daily practice of people in Indonesia. The conceptual model was developed to empower Regional Waste Management Bodies and encourage community behavior in dealing with waste piles.

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This paper begins with explaining the problem, theoretical study, and development of a conceptual model, methodology, and discussion of results, conclusions, limitations, and recommendations for further research. This research provides theoretical findings related to the importance of providing incentives for people's behavior intention in managing their waste and increasing awareness of the environment. Governments worldwide can adopt the results of this research to overcome the waste problem and increase people's intention to manage their waste to reduce the increasing accumulation of waste. A good understanding of household waste management can improve environmental sustainability in the long term. This research is based on the theory of pro-environmental behavior (Wyss et al., 2023), which previous researchers have widely used to predict people's behavior in preserving their environment.

2. LITERATURE REVIEW

1.3 Behavioral intention and Waste management system adoption

This research seeks to analyze the influence of consumer behavioral intentions and usage behavior. Previous research shows a high relationship between behavioral intentions and pro-environmental behavior (Ates, 2020; Nguyen et al., 2019). Regular use of a waste management system (WMS) to sort waste must be part of a sustainable lifestyle to condition appropriate waste utilization for the environment. Axsen et al. (2012) define pro-environmental technologies (PETs) as "any technology that consumers can perceive as having pro-environmental attributes" (p. 64). WMS itself is an example of PET that can be used to encourage environmentally beneficial behavior such as recycling and minimizing waste production. Pro-environmental intentions do not always succeed in producing environmentally friendly behavior (Nguyen et al., 2019); Wang et al. (2020). The UTAUT2 model from Venkatesh et al. (2012) is a theory that is considered comprehensive for analyzing technology adoption. In this theory, behavioral intentions can predict actual behavior. Venkatesh et al. (2016) and Berger & Wyss (2021) explain that applying the UTAUT2 model requires changing the understanding of technology in specific contexts. This research intends to adopt WMS, and adoption behavior is the use of WMS in everyday life.

H1: Behavior intention influences waste management system adoption.

2.3 Empowerment

Empowerment combines a proactive attitude in all aspects of life, personal control, and a person's critical perception of their environment (Zimmerman, 1995; Suryanarayana, 2022). Combining several attitudes and empowering factors is essential in understanding the process of environmentally friendly behavior in social life (Varela-Candamio et al., 2018). Empowerment in a psychological community is believed to significantly influence the intention to use and recommend new technology (Naranjo-Zlotov et al., 2019). The research results of Naranjo-Zlotov et al. (2019) show that psychological empowerment can influence WMS adoption.

H2a. Empowerment has a positive effect on behavioral intentions.

H2b. Empowerment has a positive effect on waste management system.

2.3 Financial incentives – PAYT and SAYT

Pay-as-you-throw (PAYT), according to (Skumatz, 2008), can provide sustainable economic signals to change someone's behavior. Seacat & Boileau (2018) show that

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several research results state that PAYT can positively predict recycling behavior (Starr & Nicolson, 2015). The results of research by Timlett & Williams (2008) in England show that incentives influence the recycling behavior of the community. Wang et al. (2021) show that the role of financial incentives can also predict household waste-handling behavior well (Park, 2018; Skumatz, 2008; Yau, 2010). However, unfortunately, Bolderdijk & Steg (2015) show the opposite, namely that economic incentives do not permanently affect sustainable environmental behavior.

H3a. PAYT has a positive effect on the behavior intention to use waste management system.

H3b. SAYT positively influences behavior intention to use waste management system.

2.4 Pro-environmental behavior

Pro-environmental behavior (PEB) is the behavior of someone who always tries to control natural damage and preserve nature by forming personal and social norms and intrapersonal principles that are adhered to by society (Varela-Candamio et al., 2018). Suryanarayana (2022) shows that PEB significantly impacts the intention to adopt a new environmental management system. Previous research shows that people with more significant concern for environmental sustainability are willing to take action to save the environment (Bamberg & M¨oser, 2007). Thus, PEB has a good relationship with the intention to use WMS and is expected to impact the implementation of environmental management in households positively.

H4. PEB has a positive effect on behavior intention to use waste management system.

3. METHOD

The survey was conducted in Indonesia among communities in the Special Region of Yogyakarta. This research makes a survey response. Completing the questionnaire takes approximately 5 minutes, answering the questions with an additional 3 minutes of introductory information explaining the WMS. This advertorial explains the features of WMS and the advantages of the new PET. Survey measurement items were adopted from Vorobeva et al. (2022). This study used a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) to measure empowerment, PAYT, Intention, PEB, and waste management system adoption. The number of respondents in this study was 230 family members already concerned with environmentally friendly behavior. This research uses PLS-SEM to analyze the data that has been collected.

4. RESULTS

4.1 Respondent characteristics

This research used 230 respondents who were household decision-makers. Research respondent data shows that the average respondent is male (65%), aged 35-45 (72%). Most respondents' last education was high school (87%).

4.2 Validity and reliability test results

The validity and reliability testing results show that not all instruments used in this research have good validity and reliability values. $PAYT_1$, $SAYT_4$, Emp_1, and Emp_4 have a Loading factor value of less than 0.7. Thus, the four research instruments were removed from the model.

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4.3 Hypothesis test

The research results show that the intention behavior model is accepted, and not all proposed hypotheses are supported. The R^2 values obtained in this study were 0.4 and 0.514. The results of the validity and reliability analysis of the measurement models show that they are all valid and reliable. All constructs measured in this study have a Cronbach's alpha value greater than 0.70 and have good reliability with a composite reliability value greater than 0.5. The AVE value is good because all constructs are more significant than 0.5.

Table 1. Results of research hypothesis testing using path analysis

	Original Sample (O)	Sample Mean (M)	T Statistics (|O/STDEV|)	P Values	Results
Behavior Intention → WMS	0.543	0.544	10.500	0.000	Supported
Empowerment →behavior Intention	0.320	0.312	4.379	0.000	Supported
PAYT → Behavior Intention	0.262	0.267	3.908	0.000	Supported
PEB → Behavior Intention	0.041	0.049	0.582	0.561	Not Supported
PEB →WMS	0.292	0.291	5.175	0.000	Supported
SAYT → Behavior Intention	0.197	0.196	2.357	0.019	Supported

5. DISCUSSION

The results of this study show that the model is acceptable even though there is one path that is not significant, namely the PEB path to behavior intention. This research supports the opinion of Vorobeva et al. (2022), which states that not all pro-environmental behavior can lead consumers to the intention to behave pro-environmentally. This is because consumers or people in Yogyakarta have not found non-plastic substitutes for daily necessities. People in the Special Region of Yogyakarta also don't understand donating to benefit the environment and how to donate to the environment. So, the pro-environmental behavior of the community has not been able to increase their intention to adopt waste management system. Still, on the other hand, even though they have no intention, it turns out that the Special Region of Yogyakarta community wants to adopt waste management system without having any intention. The community believes that waste management system must be implemented immediately to overcome the problem of piling up waste and the lack of waste collection sites, which are now increasingly few.

Other research results that can be explained show that the Yogyakarta community has motivation through PAY-T and SAY-T to increase their intention to adopt a sound waste processing system. This waste processing system adopts and uses innovative technology in waste management (Scott et al., 2021). Apart from that, handling waste piles can also be done by increasing the empowerment of waste management through empowering regional waste processing. Yogyakarta has implemented empowered Regional Waste Management Utilities by creating rubbish dumps in each village to overcome the problem of rubbish piling up and disturbing the environment. Perceptions of punishment and rewards can increase community members' intention to carry out good waste management. The perception of punishment and rewards that will be given

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if the community does not carry out environmentally preserving behavior can increase their intention to adopt a sound waste management system and ultimately increase SMS adoption behavior.

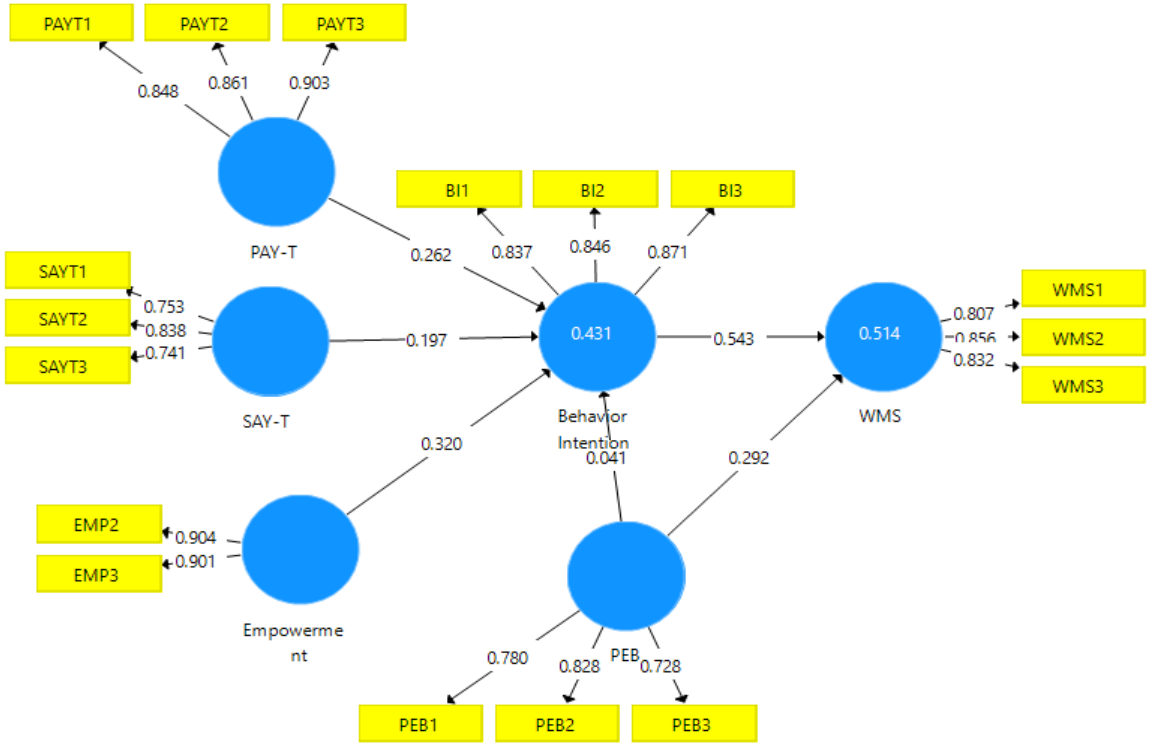

Figure 1: Model of Waste management system in the household

6. CONTRIBUTION

The results provide clear implications for ensuring community members adopt sound waste management designs. It is believed that this waste management system can reduce waste accumulation and increase environmental sustainability. The community and local government must change behavior and waste processing technology to handle the current waste pile. Axsen et al. (2012) indicate that insight into incentives (financial, environmental, and behavioral) must be dedicated to citizens' behavioral intentions and waste-handling technology usage behavior. The practical implications of the results of this research show that local governments must use the right strategy in adopting waste technology or PET in waste management. Local governments must publicize more about the risks of behavior that destroys nature and collects waste. Waste sorting technology will speed up handling waste that pollutes the environment using recycled waste as organic fertilizer or magot feed. Campaigns regarding the purchasing behavior of recycled products need to be improved. The public also needs to be given good

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knowledge about processing, sorting, and reducing waste production and the volume of waste disposal sites.

7. LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

This study only focuses on the context of waste management system adoption influenced by intention, incentives (PAYT and SAYT), pro-environmental behavior, and empowerment without considering other sectors. We suggest future research to include fundamental implementation issues or diversification among waste management. This research cannot justify the relationship between the PEB variables and intentions. Further research can deepen the testing of these two variables so that generalizations can be obtained regarding the influence of PEB on behavior intentions.

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