

Micro Small Medium Enterprises Intention to Implement Circular Economy in Solo, Indonesia

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Abstract. Indonesia's waste problem leads to severe effect such as economic, environment and social consequences in Indonesia as second largest contributor of waste in the world. Part of the waste source in Indonesia is from micro small medium enterprise sector. One of the solutions to support sustainable development goals is by implementing circular economy to combat waste. This phenomenon then can be further analysed with variables related to perception and behavior of human. This study investigates determinants of MSME's participation intention and behavior to implement circular economy for their waste in a framework that incorporates Extended theory of planned behavior (TPB). Structural Equation Modeling (SEM) then was used to analyse all the variables correlation. The results of this study are that there are 5 significant correlations between variables, namely Descriptive Norm and Attitude have a significant and negative effect on Intention to Use. This study also found that the factors Perceived Behavioral Control, Individual concern and perceived economic use had a positive and significant effect. In addition, other findings are that Perceived Usefulness and Perceived Effectiveness and perceived environmental knowledge do not have a significant effect on Intention to Use.

1 Introduction

Indonesia, a massive country with over 275 million people in it was combating with waste emergency. This phenomenon alarmed the Ministry of Indonesian Forest and Environment who estimated that average waste to be 0.07 kg per person (8% of the total waste rate, or 0.87 kg per person per day). [1]. According to this information, garbage amounted 7 millions tons were generated, of which 4.9 million tons were claimed to have been improperly managed and released into the natural reservoir [2] policy maker substantially increase the awareness regarding plastic pollution by applying regional waste management strategies with the goal of reducing solid waste at source by 30% by 2025, in accordance with Presidential Decree No. 97/2017 on National Policies and Management Strategies for Domestic and Similar Wastes (Jakstrada) [3]. Other thing to address is about our single-use plastics waste (shopping bags, straws, polystyrene wrappers, etc.). One initiative to address this issue is the introduction of a circular economy [4].

The circular economy is defined as a system of economic that holds materials and goods in use for as long as feasible in order to maximize used resource and minimize waste [4]. Circular economy has three distinctive characteristic which are try to do restoration rather than efficiency of waste, engineered out sustainability concept from waste and pollution and try to eliminate waste and pollution as much as possible. Another circular economy principle is keeping products and materials in use through repair, reuse and recycling [5]

The circular economy seeks to replace the linear "take, make, dispose" model with a "reduce, reuse,

recycle" framework that is more environmentally friendly. Thanks to the circular economy, the environmental impact is reduced and there are opportunities for people to be creative and innovative to boost economic development [6]. In the past few years, the notion of economic circular has surfaced as a sustainability blueprint, the ability to regenerate itself, and the revaluation of conventional production models that rely on excessive use of resources and the discarding of used items. This concept rethinking the entire chain of supply from concept to production, use, disposal and innovations and technologies that turn waste into resources. The circular economy means that company enables them to become more resilient and competitive to achieve their goals that have a positive impact on the environment [7].

Nonetheless, shifting to circular economy requires a cooperation among educational and research institution, industry, governments and consumer. The economic circular is diverse and involves all stakeholders. We need a shared vision for circular economic transition and need to bring stakeholders together to develop transformational strategies [8]. The rapidly evolving of circular economic into a model of sustainability and a self-renewable economy. Industrialization has improved people's living standards, but it has also destroyed the environment through overconsumption and overproduction. The circular economy is based on two main aspects, both biologically and technically. The goal of the circular economy is to minimize polluting waste by preserving materials in closed-loop systems for as long as possible. Aspects of biology and technology play a major role in this system in enabling more resource-efficient use of those resources [9].

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In the other hand, being a developing nation, Indonesia struggles on economy. Indonesia's economy nowadays is supported by Micro Small and Medium Enterprises (MSMEs) consisting approximately 52 million units and amounting to 60% Gross Domestic Product (GDP) contribution [10]. Tambunan asserts that SMEs are an engine for the Indonesian national economy because these units are more numerous than large enterprises. They are scattered widely throughout rural areas and have considerable employment growth potential. Their development or growth can be included as an important element of policies to create employment and generate income. Although SMEs are an employee absorber and represent the backbone of economies in developing countries, they still have classic problems. And one of them is they can shift to implement circular economy as it will give some benefits to the MSMEs [11]. But to this day, there is few research that especially discuss MSMEs willingness to implement Circular Economy to boost their company.

Based on the explanation, this paper examines the motivation from MSME to implement circular economy, what factors influence this phenomenon, and how policy makers can use this research to better prepare the MSMEs and contributing in Sustainable Development Goals are the questions that make this research important. The results of this study are expected to be the basis of information for policy makers in making rules, especially related to the implementation of circular economy.

2 Methods

One of the behavioral model theories commonly used in behavior and perception-related research is Theory of Planned Behavior (TPB). TPB has been used specifically to analyze perception and habits in various studies around the world. Related to circular economy, research by Zhang et al [12] has developed the TPB variable into variables namely Attitude, Descriptive Norms, Perceived Behavioral Control, and Comfort. This TPB variable can then also be combined with other theories regarding human perception such as the Protection Motivation Theory (PMT). The combination of TPB and PMT can be seen in the study by Prasetyo et al [13] which examined the perception of the level of effectiveness of circular economy in the Philippines. PMT variables are Perceived Effectiveness and Perceived Vulnerability. In addition to TPB and PMT, several studies related to human behavior and psychology show an interesting fact that human psychology is equipped with individual concern. All these variables can then be analyzed for correlation with Structural Equation Modeling (SEM) which is an advanced statistical analysis technique related to the relationship between multi-variables in a tested model.

This research then used a modified TPB questionnaire and was given to 240 samples of respondents of MSMEs workers. The respondents was selected in Solo, Central Java because this area consisted of various MSMEs. The demography was 66% man and

34% woman and after a set of validity and reliability testing, 38 of data was invalid or unreliable, so the total data of this research was 202 respondents. Research by Erdiaw-Kwasie [14] which states that knowledge about circular economy, aspect of organizational factors, and the adoption of circular economy are related. Therefore, this study proposes:

1. H1: Perceived circular economy knowledge is significantly correlated with intention to use.

Research by Nittono, [15] also emphasizes the importance of forming a perception for everyone that an action, no matter how small, will have an impact and contribute to society at large. This is important because there is a tendency for a person's perception that the larger the scale faced, the more ineffective the person's behavior will be. Therefore, this study proposes:

2. H2: Perceived effectiveness is significantly correlated with intention to use.

Research by Singh [16] which states that when an individual faces something that is considered significant economically or there is lack economic incentives, they will be motivated to perform behavior that can protect it. Things that are done such as taking preventive actions that can reduce the risk of these threats Therefore, this study proposes:

3. H3: Perceived economic use is significantly correlated with intention to use.

Research by Chakraborty [17] where more than 40% of respondents felt something related to environment will stimulate them to use its product. Therefore, this study proposes:

4. H4: Perceived environment knowledge is significantly correlated with intention to use.

Research by Kumar et al [18] which states that self-efficacy has a significant impact on a person's capability in doing a task. Self-efficacy means a person's belief and confidence in his own ability to successfully do something. Therefore, this study proposes:

5. H5: Perceived behavioral control is significantly correlated with intention to use.

Research by [19] confirms that individual behavior is influenced by the norms that exist in their community. Other research also confirms that there is a strong relationship between norms and compliance behavior in an organization or society [20]. Therefore, this study proposes:

6. H6: Descriptive norms have a significant correlation with intention to use

Many studies confirm that people will comply with the rules, conditions and guidelines given if they have a positive who ignore certain habits will not comply with the given guidelines [21] Therefore this study proposes

7. H7: Attitude is significantly correlated with intention to use.

Perceived Usefulness is defined as "How far a person believes that a particular system can improve a person's performance" [22] This variable becomes the determining factor of a person's behavior towards something. This means that if residents feel the satisfaction and benefits of implementing circular economy, they will continue to implement it based on their own wishes. Therefore, this study proposes

H8: Perceived usefulness is significantly correlated with intention to use.

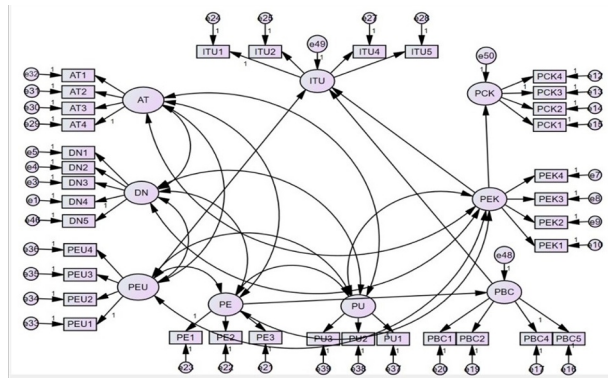


Fig 1. Structural equation model

3 Results and Discussion

Table 1. AMOS results.

	Estimate	S.E.	C.R.	Description
ITU<--- PCK	.220	.113	1.950	Significant
ITU<--- PE	.028	.109	.253	Not Significant
ITU<--- PEU	-.208	.108	1.928	Significant
ITU<--- PEK	.209	.111	1.880	Significant
ITU<--- PBC	.028	.139	.203	Not Significant
ITU<--- DN	-.102	.120	-1.740	Significant
ITU<--- AT	-.053	.130	-1.262	Significant
ITU<--- PU	.083	.096	.860	Not Significant

Figure 1 is modeling in AMOS based on the theoretical framework. From Table 1 the results of the data output above, it is known that there are five significant hypotheses, namely H1 is Perceived *Circular economy* Knowledge (PCK) positively affects intention of use (ITU), H3 is Perceived Economic Use (PEU) positively affects intention of use (ITU). H4 is Perceived Environment Knowledge (PEK), and the interesting thing is H6 and H7 which rejects the hypothesis because Descriptive Norms (DN) and Attitude (AT) has a negative effect on intention of use (ITU).

This study found that the Perceived Circular economy Knowledge (PCK) variable had a significant and positive effect on MSMEs workers respond to circular economy. These results are based on model testing with AMOS which produces a CR value of 1.950 from the standard 1.96, a P value of 0.051 from the standard 0.05 and an estimate of 0.220
 This study then imply that the Attitude (AT) variable had negative significant effect on the MSMEs workers to implement circular economy. These results are based on model testing with AMOS which produces a CR value of -1.262 from the 1.96 standard, a P value of 0.89 from the 0.05 standard and an estimate of -0.53.

This study also conclude that the descriptive norms variable had significant and negative effect on the implement circular economy. These results are based on model testing with AMOS which produces a CR value of -1.740 from the 1.96 standard, a P value of 0.75 from the 0.05 standard and an estimate of -0.102. This result can occur because social norms in the respondent's environment have not been formed to be disciplined in implement circular economy in particular. This is in accordance with research by [23] which confirms that individual behavior is influenced by the norms that exist in their community. The results of this study encourage the mental formation of the community to be disciplined in maintaining waste management.

This study also summarize that the Economic Use variable had a significant and positive effect on residents' desire to implement circular economy. These results are based on model testing with AMOS which produces a CR value of 1.928 from the standard 1.96, a P value of 0.054 from the standard 0.05 and an estimate of 0.208. This is in accordance with research by [24] which states that economical side and incentive is vital to implement circular economy. The result from Perceived Economic Knowledge also gives similar result with CR value of 1.880 from the standard 1.96, a P value of 0.060 from the standard 0.05 and an estimate of 0.209. This means that the society will motivate more to implement circular economy if they are benefit from it economically.

This study then discover that the Perceived Usefulness variable had no significant effect on the residents' desire to implement circular economy. These results are based on model testing with AMOS which produces a CR value of 0.860 from the 1.96 standard, a P value of 0.39 from the 0.05 standard and an estimate of 0.083. This means that circular economy is still not considered useful by respondents. This study recommends being able to focus on increasing the perception of use value when implementing circular economy. This study also detect that the Perceived Effectiveness variable had no significant effect on the residents desire to implement circular economy. These results are based on model testing with AMOS which produces a CR value of 0.253 from the 1.96 standard, a P value of 0.800 from the 0.05 standard and an estimate of 0.028. The results of this study indicate that people still feel that circular economy will not give significant impact.

4 Conclusion

This study has determined that knowledge about circular economy and the environment significantly influences MSMEs workers' decisions to implement circular economy practices. This effect stems from the satisfaction and sense of reward experienced when individuals implement actions, they understand to be beneficial. Additionally, perceiving the ease of implementing circular economy practices enhances implementation efforts, as it facilitates learning and

engagement with circular economy principles and sustainability concepts.

This study also yielded an intriguing finding, indicating that both attitude and descriptive norms have a negative impact on the implementation of circular economy practices. This may be attributed to individuals perceiving a lack of necessity to adopt circular economy practices, particularly if their social environment does not prioritize or endorse such behaviors. This finding underscores the significance of government initiatives aimed at increasing awareness about the importance of social responsibility and fostering a societal shift towards prioritizing environmental and social concerns. Such efforts could play a crucial role in encouraging greater adoption of circular economy practices and promoting sustainable behaviors within communities.

This study also uncovered another noteworthy observation, namely that perceptions related to effectiveness (Perceived Effectiveness) and usefulness did not yield significant results. This suggests that residents perceive circular economy as somewhat useless and ineffective for them. This phenomenon may be linked to attitudes and descriptive norms, as individuals may not perceive significant differences resulting from the adoption of circular economy practices. This highlights the importance of addressing misconceptions and enhancing understanding about the tangible benefits and impacts of circular economy practices to encourage greater acceptance and participation in such initiatives.

References

1. J.R. Jambeck, R. Geyer, C. Wilcox, T.R. Siegler, M. Perryman, A. Andrady, R. Narayan, K.L. Law. Plastic Waste Inputs From Land Into The Ocean. *Science*. **347**: 768–771. (2015).
2. Y. Ren, R. Li, K.J. Wu, M.L. Tseng. Discovering the Systematic Interlinkages Among the Circular Economy, Supply Chain, Industry 4.0, and Technology Transfer: A Bibliometric Analysis. *Cleaner And Responsible Consumption*. **9(4)**. (2023).
3. Danardono, E. B. Putra, E. Haryono, E. Nurjani. Speleoclimate Monitoring to Assess Cave Tourism Capacity in Gelatik Cave, Gunungsewu Geopark, Indonesia, *Forum Geografi*, **31** (2) : 181–194. (2022).
4. T. Domenech, B. Walkowiak. Transition Towards A Resource Efficient Circular Economy in Europe: Policy Lessons From The EU And The Member States. *Ecological Economics*. **155**: 7–19. (2019).
5. B. Surya, S. Syafri, H. Sahban, H. H. Sakti. Natural Resource Conservation Based on Community Economic Empowerment: Perspectives on Watershed Management and Slum Settlements in Makassar City, South Sulawesi, Indonesia. *Land*. **9(104)**: 1–32. (2020).
6. C. Martin. The Agile Supply Chain: Competing in Volatile Markets. *Industrial Marketing Management*. **29(1)**: 37–44. (2000).
7. A. Szalavetz. Industry 4.0 and Capability Development in Manufacturing Subsidiaries. *Technological Forecasting & Social Change*. **145**: 384–395. (2019).
8. E. Hettich, M. Kreutzer. Strategy Formation Across Organizational Boundaries: an Interorganizational Process Model. *British Journal of Management*. **32** (1): 147–199. (2021).
9. R. Merli, M. Preziosi, A. Acampora. How Do Scholars Approach the Circular Economy? A Systematic Literature Review. *Journal Of Cleaner Production*. **178**: 703–722. (2018).
10. F. E. Garcia-Muina, R. Gonzalez-Sanchez, A.M. Ferrari, D. Settembre-Blundo. The Paradigms of Industry 4.0 and Circular Economy as Enabling Drivers for the Competitiveness of Businesses and Territories: The Case of an Italian Ceramic Tiles Manufacturing Company. *Social Science*. **7(12)**: 1–32. (2018).
11. M. Miftahorrozi, S. Khan, M.I. Bhatti. Waste Bank-Socio-Economic Empowerment Nexus in Indonesia the Stance of Maqasid Al-Shari'Ah. *Journal of Risk and Financial Management*. **15** (7): 1–23. (2022).
12. A.Y. Bagastyo, A.D. Anggrainy, M.S. Liang. Assessment of Attitude and Participation Level Among the Households and Local Merchants Toward Single-Use Plastic Waste Management: A Case Study in Balikpapan Municipality, Indonesia. *Case Studies in Chemical and Environmental Engineering*. **7**:1–8. (2023).
13. M. H. Davis. A Multidimensional Approach to Individual Differences In Empathy. *JSAS Catalog of Selected Documents in Psychology*. **10** (85). (1980).
14. F. Hellmich, M. F. Loper, & G. Gorel. The Role Of Primary School Teachers' € Attitudes And Self-Efficacy Beliefs For Everyday Practices In Inclusive Classrooms E A Study On The Verification Of The 'Theory Of Planned Behaviour'. *Journal of Research in Special Educational Needs*. **19** (1): 36–48. (2019).
15. B. Zhang, S. Yang, J. Bi. Enterprises' Willingness to Adopt/Develop Cleaner Production Technologies: an Empirical Study in Changshu, China. *Journal of Cleaner Production*. **40**, 2013, 62–70. (2013).

16. M. J. J. Gumasing, Y. T. Prasetyo, A. K. S. Ong, R. Nadlifatin. Determination of Factors Affecting the Response Efficacy of Filipinos Under Typhoon Conson: an Extended Protection Motivation Theory Approach. *International Journal of Disaster Risk Reduction*. **70**. (2022).
17. H.Z. Hadibasyir, S.S. Rijal, D. Sari. Comparison of Land Surface Temperature During and Before The Emergence of Covid-19 Using Modis Imagery in Wuhan City, China. *Forum Geografi*. **34** (1) : 1-15, (2020).
18. J. Urakami, N. Qie, X. Kang, P. P. Rau. Cultural Adaptation of “Kawaii” in Short Mobile Video Applications: How the Perception of “Kawaii” is Shaped by the Cultural Background of the Viewer and the Gender of the Performer. 2021 *Computers in Human Behavior Reports*. **4**: 1-10. (2021).
19. M. O. Erdiaw-Kwasie, M. Abunyewah, S. Yusif, A. Erdiaw-Kwasie. Does Circular Economy Knowledge Matter in Sustainable Service Provision? A Moderation Analysis. *Journal of Cleaner Production*. **383** (10):1-17. (2022).
20. H. Nittono. The Two-Layer Model of Kawaii[^]: A Behavioural Science Framework For Understanding Kawaii And Cuteness. *East Asian Journal of Popular Culture*. **2**(1): 79-95. (2016).
21. M.P. Singh, A. Chakraborty, M. Roy. Developing an Extended Theory of Planned Behavior Model to Explore Circular Economy Readiness in Manufacturing MSME's, India, *Resource, conservation & Recycling Journal*. **135**: 313-322. (2018).
22. A. Chakraborty, M.P. Singh, M. Roy. A Study of Goal Frames Shaping Pro-Environmental Behaviour in University Students. *International Journal of Sustainability in Higher Education*. **18** (3). (2017).
23. O. A. Alausa, O. S. Adaradoun. G. T. Adekunle, K. D. Priyono. Leveraging Geospatial Technology for Enhanced Utility Management: A Case Study in Electrical Distribution Power Systems. *Forum Geografi*. **37** (2) : 164-177. (2023).
24. A. Ridwan, T. R. Ambarwaty, N. Wahyuni, D. L. Trenggonowati, A. Bahauddin, A. Umyati, B. Kurniawan. Evaluating Economic and Environmental Impact of A Plastic Waste Processing Industry Based on Circular Economy Using Benefit-Cost Analysis. *Jurnal Ilmiah Teknik Industri*. **21**(2): 230-237. (2022).