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Knowledge, Behavior, Awareness, and Policy Towards E-Waste Management Performance Among Malaysian SMEs

Mohd Akhir Ahmad[1*], Muhd Hakimi Razak[1] and Rosman Iteng[1]

[1]School of Technology Management & Logistics (STML), Universiti Utara Malaysia (UUM), 06010 Sintok, Kedah.

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ABSTRACT

With an emphasis on the effects of knowledge, awareness, behavior, and policy on e-waste management performance, this study examines how small and medium-sized enterprises (SMEs) in Malaysia can manage their electronic waste (e-waste). The goal is to promote effective variables towards e-waste management performance that mostly lack study among SMEs in Malaysia. This study gives the management solutions that are required due to the increasing output of e-waste caused by factors such as rapid population expansion, technological improvements, and rising prosperity in Malaysian SMEs. Data gathered from SMEs in Malaysia is analyzed using a quantitative study methodology. This study uses SPSS ver.24 for data analysis. The results show a substantial positive significance between e-waste management performance and knowledge, behavior, awareness, and policy. Furthermore, multiple regression research shows these variables are most significant in e-waste management performance. The study results also emphasize the significance of all-encompassing approaches that promote sustainable e-waste management practices. These approaches should include knowledge, behavioral modification, increased awareness, and supporting policy frameworks among stakeholders in the SMEs industry. Through the clarification of the complex nature of efficacious strategies and the resolution of SMEs' obstacles, this study advances the waste management ecosystem. Businesses, scholars, and governments looking to enhance e-waste management in Malaysia and comparable settings throughout the globe might benefit greatly from its insights.

Keywords: E-waste management performance, Knowledge, Behavior, Awareness, Policy.

1. INTRODUCTION

Electronic waste (E-waste) generation has surged due to the fast growth of electrical and electronic equipment (EEE) worldwide, creating serious health and environmental risks. Shorter product lifespans, urbanization, and economic expansion all contribute to the problem of e-waste, which is generated when outdated EEE is disposed of [1]. Although technology improves people's lives, Malaysia struggles with increasing e-waste due to poor infrastructure and unfavorable attitudes towards recycling [2]. To solve this, it is essential to enforce Extended Producer Responsibility (EPR) programmes, put strong E-waste management plans into place, and promote consumer knowledge and appropriate disposal techniques [3, 4].

The hazardous nature of e-waste, which threatens ecosystems and human health, is the driving force behind growing worries about it. Heavy metals, chemicals, and flame retardants in e-waste pose a serious environment threat with far-reaching effects [5]. The need to lessen the impact of e-waste is becoming more urgent due to population expansion and technology improvements [6]. Furthermore, research indicates that exposure to E-waste might have negative health impacts,

*Corresponding author: makhir@uum.edu.my

such as thyroid malfunction and DNA damage. This underscores the need for effective E-waste management procedures [7].

Table 1: Percentage of Each Type of E-Waste 2022.

Type of E-Waste	Waste Collection (Percentage)
Handphone	16
Refrigerator	7
Air-Conditioner	2
Television	20
Washing Machine	5
Computer/Laptop	50

Note. From E-Waste Management in Malaysia, by Malaysia Department Environment Water, 2022. (https://ewaste.doe.gov.my/index.php/infographic/) Copyright 2022 by Department of Environment Water.

According to the Malaysia Department of Environment Water in Table 1, the most e-waste generated by the citizens is computers/laptops which is 50 percent. In other words, half of the type of e-waste is a computer/laptop. Second is television which is 20 per cent. It can be seen that Malaysians rarely recycle computer waste. By 2025, Malaysia is estimated to create 24.5 million units of e-waste. Inappropriate and unethical e-waste disposal can seriously threaten human and environmental health. Mobile phone users create significant waste in Malaysia [8]. Improving the ability of small and medium-sized business (SMEs) to handle e-waste is a critical requirement in Malaysia. SMEs may contribute substantially to sustainable E-waste management practices by comprehending and addressing elements including staff awareness, behaviors, knowledge, and policy linked to E-waste [9]. These initiatives are essential to meeting the 2030 global sustainable development goals, which include reducing health risks and

2. LITERATURE REVIEW

This study investigated the relationship between several important variables and e-waste performance management. Several important variables, such as knowledge, behavior, awareness, policy, and e-waste performance among SMEs in Malaysia, are described and conceptualized in this study. The performance of e-waste management in SMEs is hypothesized to be highly influenced by knowledge, behavior, awareness, and policy. These hypotheses are developed to investigate these links to e-waste management performance. The conceptual framework defines the mutual dependence of these factors, predicated on the idea that improved e-waste management techniques stem from increased knowledge, behavior, awareness, and policies. The underlying theories of diffusion of innovation and behavioral reasoning offer theoretical frameworks for comprehending how individual action and the spread of new practices impact e-waste management inside SMEs.

2.1 Knowledge

The handling, disposal, and environmental effects of electronic trash are only a few topics covered by knowledge about e-waste management. Research indicates that education and awareness campaigns are important for raising public understanding and awareness of the threats to their health and the environment that come with inappropriate e-waste disposal [10]. Studies have shown that there are gaps in knowledge and comprehension across different groups, such as students and local communities, which highlights the need for more education and awareness campaigns [2, 4, 11]. Although some people are well-versed in e-waste, some still do not fully comprehend e-waste management procedures, highlighting the need for extensive education and awareness campaigns [12]. Consequently, to lessen the negative impacts of e-waste on the

environment and public health, further efforts must be made to inform the public about the associated risks and encourage safe disposal methods.

2.2 Behavior

Due to the need for sustainable solutions that consider social, economic, and environmental concerns, consumer behavior in e-waste management has become a crucial subject of research worldwide [13]. Understanding consumer perceptions and attitudes towards e-waste management is crucial, since attitudes substantially impact consumer behavior surrounding purchasing and disposing of electrical and electronic equipment (EEE) [10]. Research suggests that many customers would rather keep outmoded equipment at home than participate in recycling programmes, despite the increased awareness and interest in responsible e-waste processing and recycling [14]. Habits, attitudes, and perceptions are among the factors influencing customers' intents to recycle e-waste, underscoring the importance of thorough assessments of e-waste disposal behavior and its causes [15]. Nonetheless, obstacles like consumer reluctance and the lack of uniform recycling laws impede consumers' ability to recycle e-waste effectively, highlighting the significance of comprehending the elements affecting consumers' involvement in e-waste recycling programmes [16, 17, 18].

2.3 Awareness

Small and medium-sized businesses (SMEs) need to be aware of the social, legal, health, and environmental implications of electronic trash (e-waste) to manage it properly [19]. Developing effective long-term solutions requires improving knowledge, behavior, and practice, for establishing sustainable e-waste management systems [20]. To preserve resources and lessen the influence on the environment, it is essential to promote e-waste recycling through environmental awareness, education about its advantages, and improved recycling accessibility [2, 21]. The need for increased awareness and promotion of correct disposal procedures to prevent health hazards and environmental pollution is highlighted by disparities in household knowledge and behaviours regarding the disposal of e-waste [22, 23]. Informed consumer education is essential to manage the growing e-waste crisis, as evidenced by the strong effect of factors like convenience of recycling, understanding of value, and awareness of dangers on consumer decisions about e-waste disposal [24, 25].

2.4 Policy

Organizational culture and leadership significantly impact company policies in Small and Medium Enterprises (SMEs) concerning the management of electronic trash, or e-waste. This is important because it promotes corporate ecological responsiveness [26]. Because serious health concerns are associated with informally recycling e-waste, workers must get occupational safety training, personal protective equipment, and educational programmes to raise awareness [27, 28]. Comprehensive remediation initiatives to increase public awareness are necessary to address health concerns associated with uncontrolled e-waste recycling [28]. E-waste management has become more popular worldwide, with wealthy countries passing laws and highlighting the need for international collaboration to carry out policies successfully [29, 30, 31]. Further research into the relationship between legislative frameworks and e-waste management performance is necessary because legislative reforms facilitate collaboration between the official and informal sectors and implement sustainable e-waste governance practices [32, 33].

2.5 E-Waste Management Performance

To reduce the dangers to the environment and public health connected with the disposal of electronic waste, effective e-waste management performance depends on a multifaceted strategy that includes consumer awareness, sustainable behaviors, and technology improvements (Figure 1) [34]. Even though the urgent need for sustainable e-waste management is becoming more widely acknowledged, many developing nations still struggle with poor infrastructure, lax laws, and low awareness, making it challenging to adopt practical solutions [35]. To solve the growing global e-waste challenge, the research emphasizes combining the official and informal sectors, enforcing legislation, increasing consumer awareness, and investing in recycling infrastructure [36, 37].

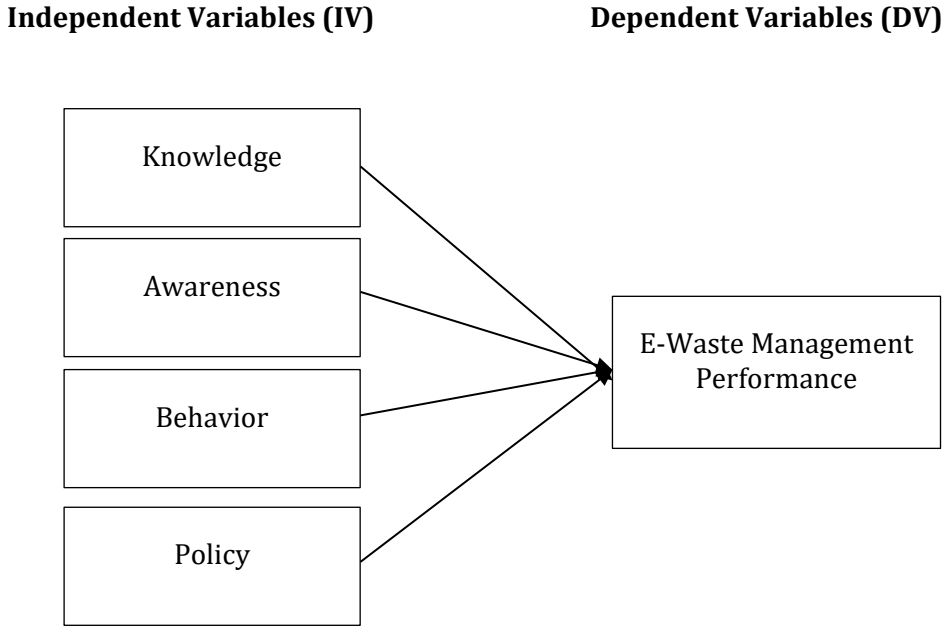

Figure 1: Conceptual framework.

The following hypotheses are proposed:

Hypothesis 1: Knowledge significantly influenced E-Waste Management Performance among SMEs in Malaysia.
Hypothesis 2: Behavior significantly influenced E-Waste Management Performance among SMEs in Malaysia.
Hypothesis 3: Awareness significantly influenced E-Waste Management Performance among SMEs in Malaysia.
Hypothesis 4: Policy significantly influenced E-Waste Management Performance among SMEs in Malaysia.
Hypothesis 5: Knowledge, awareness, behavior, and policy significantly influenced SMEs' performance in E-waste management in Malaysia.

3. RESEARCH METHODOLOGY

This study uses a quantitative research approach to examine how knowledge, awareness, behavior, and policy affect how well SMEs in Malaysia manage their e-waste. Based on the study by Krejcie and Morgan (1972) [38], the researcher intends to gather data from SMEs using

probability sampling, more precisely, simple random sampling. The questionnaire is divided into two sections: questions about demographics using a nominal scale and independent and dependent variables using an interval scale with a Likert-type rating scale. Both online and in-person techniques will be used to collect the data; questionnaires will be used to acquire primary data, and previous papers will be used to collect secondary data.

For data analysis, including demographic analysis, hypothesis testing, Pearson correlation, and multiple regression, the Statistical Package for the Social Sciences (SPSS) will be used. This extensive study design aims to offer insightful information about enhancing e-waste management procedures in SMEs, hence promoting environmental sustainability and regulatory compliance. The pilot test was conducted by giving out the questionnaires to several candidates to test the validity of the questionnaires.

4. FINDINGS

4.1 Demographic Of Respondents

The study's results provide a thorough demographic summary of SMEs, highlighting a range of factors like gender, age, race, firm creation year, and organization type based on the tables. Malays made up the majority of the racial demography, which is 61.5 percent (Table 2), although gender representation was balanced with a mix of male and female representatives (Table 3). Approximately 62.25 percent of the SME representatives were between the ages of 21 and 30, which may indicate they were prepared for entry-level positions (Table 4). This is likely due to the practical training frequently included in vocational programmes. Most of the 51.25 per cent were SMEs founded between 2001 and 2015 (Table 5), indicating a developed business environment. Moreover, firms that prioritized their products outperformed those that were service-oriented (64 percent vs. 36 percent), demonstrating Malaysia's dominance in manufacturing (Table 6).

Table 2: Respondents' Race.

Items	Category	Frequency	Percent
Race	Malay	246	61.5
	Chinese	94	23.5
	Indian	17	4.25
	Others	43	10.75

Table 3: Respondents' Gender.

Items	Category	Frequency	Percent
Gender	Male	202	50.5
	Female	198	49.5

Table 4: Respondents' Age.

Items	Category	Frequency	Percent
Age	Under - 20	2	0.5
	21 – 30	249	62.25
	31 – 40	121	30.25
	41 - Above	28	7

Table 5: Organization Established Year.

Items	Category	Frequency	Percent
Established Year	Under – 1975	47	11.75
	1976 – 2000	114	28.5
	2001 – 2015	205	51.25
	2016 – Above	34	8.5

Table 6: Organization Variety.

Items	Category	Frequency	Percent
Variety	Product	256	64
	Service	144	36

4.2 Normality Test for Data Analysis

Table 7 shows that the data at hand indicates that the following independent variables have slightly negatively skewed distributions: Knowledge (Kurtosis = -0.472), Behavior (Kurtosis = -0.396), Awareness (Kurtosis = -0.102), and Policy (Skewness = -0.216). Their Kurtosis values indicate that these variables are near-normally peaked: knowledge (Kurtosis = 0.240), behavior (Kurtosis = 0.748), awareness (Kurtosis = -0.111), and Policy (Kurtosis = 0.133), except for behavior, which is moderately peaked (Kurtosis = 0.748). Comparably, the dependent variable E-Waste Performance has a distribution that is moderately peaked (Kurtosis = 0.438) and somewhat negatively skewed (Skewness = -0.391), similar to the pattern seen in behavior. This shows that although most independent variables have distributional patterns comparable to each other, behavior stands out as having a heavier-tailed distribution.

Table 7: Skewness and Kurtosis Value.

Variable	Knowledge	Behavior	Awareness	Policy	E-Waste Performance
Skewness	-0.472	-0.396	-0.102	-0.216	-0.391
Kurtosis	0.240	0.748	-0.111	0.133	0.438

4.3 Cronbach's Alpha Value

Table 8 shows that the purpose of using Cronbach's Alpha is to evaluate the instruments' internal consistency on a scale. Cronbach Alpha value below 0.6 considered poor, 0.6 to 0.69 is considered acceptable, 0.7 to 0.89 is considered good, and 0.9 to above is considered excellent. The results show that the Cronbach Alpha value for Knowledge (α=0.750), Behavior (α=0.662), Awareness (α=0.714), Policy (α=0.636), and E-Waste Performance (α=0.720) are all considered good.

Table 8: Cronbach's Alpha Value.

Variable	Cronbach's Alpha	Number of Items
Knowledge	0.750	6
Behavior	0.662	6
Awareness	0.714	6
Policy	0.636	6
E-Waste Performance	0.720	4

4.4 Pearson Correlation

Table 9 shows the variable mean E-Waste Performance (DV) exhibited a moderate positive correlation with behavior (IV2) (r = 0.425), awareness (IV3) (r = 0.473), and policy (IV4) (r = 0.483), indicating a robust relationship between these variables. On the other hand, variable mean E-waste performance (DV) showed a weak correlation with knowledge (IV1) (r = 0.291). In summary, the results indicate that the higher the level of positive correlations of the independent variables (knowledge, behavior, awareness, policy), the higher the E-waste performance (DV). All the relationships are positive and significant.

Table 9: Pearson Correlation.

Independent Variables	Pearson Correlation
Knowledge	0.291
Behavior	0.425
Awareness	0.473
Policy	0.483

4.5 Model Summary

Table 10 shows the model summary indicates that the Knowledge (IV), Behavior (IV), Awareness (IV), Policy (IV), and E-Waste Performance (DV) have a moderate positive relationship with a value of 0.548. This shows that the IV is around 55 percent of the changes in the DV, showing a clear and moderate relationship.

Table 10: Model Summary.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.548	0.300	0.293	0.51720

Regression coefficients are provided in column Unstandardized 'B' of the coefficient table in Table 11, which aids in determining the regression equation. The first is the y-intercept, or constant, and the second is the dependent variable's (Y) regression coefficient on the independent variable (X).

Table 11: Coefficient Table.

Model	Unstandardized B	Significant
(Constant)	1.629	< 0.001
Knowledge ($\boldsymbol{x_1}$)	-0.129	0.019
Behavior ($\boldsymbol{x_2}$)	0.265	< 0.001
Awareness ($\boldsymbol{x_3}$)	0.213	< 0.001
Policy ($\boldsymbol{x_4}$)	0.284	< 0.001

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4$$
$$y = 1.629 + (-0.129)x_1 + (0.265)x_2 + (0.213)x_3 + (0.284)x_4$$

Note: y is the dependent variable. a is the intercept. b_1, b_2, b_3 …… b_n are the coefficients representing the effect of each independent variable. x_1, x_2, x_3 …… x_n are the independent variables.

In a linear regression equation, the connection between the independent variables X and the dependent variable Y is represented by coefficients, and the constant term represents Y's

expected value when all independent variables are zero. According to the result, knowledge has a considerably negative relationship with the dependent variable, but behavior, awareness, and policy have significantly favorable relationships. This suggests that while increasing knowledge is connected to lower performance levels, higher behavior, awareness, and policy levels are associated with stronger e-waste management performance. Conduct, awareness, and policy explain almost 55% of the variation in e-waste management performance, demonstrating their substantial impact on SMEs in Malaysia.

4.6 Summary Hypothesis

The research aimed to evaluate how different factors affected the performance of e-waste management among SMEs in Malaysia. Hypotheses were developed to find out how knowledge, behavior, awareness, and policy affected the effectiveness of E-waste management. The findings showed that although there was little association between knowledge and e-waste performance, there was a moderately high correlation between behavior, awareness, and policy, with policy demonstrating the strongest relationship. A moderate association was established, with the independent factors accounting for around 55 per cent of the variance in e-waste management performance. The results validate the hypotheses by indicating that e-waste management performance among SMEs in Malaysia is heavily influenced by behavior, awareness, and policy. This underscores the significance of these elements in fostering efficient e-waste management practices.

Table 12: Summary Hypothesis Significant Table.

Hypotheses	Statement	Result
Hypothesis 1 (H1)	Knowledge significantly influenced e-waste management performance among SMEs in Malaysia *(H1)*	Significant
Hypothesis 2 (H2)	Behavior significantly influenced e-waste management performance among SMEs in Malaysia *(H2)*	Significant
Hypothesis 3 (H3)	Awareness significantly influenced e-waste management performance among SMEs in Malaysia *(H3)*	Significant
Hypothesis 4 (H4)	Policy significantly influenced e-waste management performance among SMEs in Malaysia *(H4)*	Significant
Hypothesis 5 (H5)	Knowledge, awareness, behavior, and policy significantly influenced e-waste management performance among SMEs in Malaysia (*H5)*	Significant

Table 12 shows that all the hypotheses are significant. The findings generally confirm the connections investigated in the study, indicating positive support for the study's theoretical framework or research aims when all research hypotheses are significant.

4.7 Discussion

Important information regarding the respondent community was gleaned from the demographic research of SMEs in Malaysia. These included a greater response rate to paper questionnaires than to online ones and a balanced gender distribution with a majority of Malay respondents. Young, single people with credentials made up most responders, suggesting a shift towards entry-level jobs and vocational training. Furthermore, a sizable number of mostly product-focused SMEs were established between 2001 and 2015, highlighting Malaysia's manufacturing prowess. Using SPSS techniques for hypothesis testing, it was shown that although knowledge improved the effectiveness of e-waste management, there were higher relationships between behavior, awareness, and policy. Results highlight how crucial proactive measures, raised awareness, and encouraging regulatory frameworks are to successful e-waste management in SMEs. The study's findings have important ramifications for academics, corporations, and legislators who wish to

further sustainability initiatives in the area. They emphasize the necessity of focused interventions and rules to support sustainable e-waste management practices.

5. Implications and Conclusions

The results of a study on e-waste management among SMEs in Malaysia show that, although knowledge is important, behavioral patterns, awareness, and legislative frameworks that promote e-waste management have a bigger influence. The response rate for offline surveys was greater than for online ones, suggesting that SMEs have difficulty reaching their target audience online. The study's conclusions illuminated the many traits of SMEs in the area, revealing strong relationships between policy, behavior, and awareness and the effectiveness of e-waste management. Nevertheless, the study had a few limitations, including problems distributing the questionnaire and a lack of resources. To guarantee reliable data reporting, future recommendations should consider investigating different approaches to data gathering, broadening the geographic scope, and improving respondents' comprehension. Adopting focused interventions and legislation to support sustainable e-waste management practices among SMEs in Malaysia and abroad ultimately depends on cooperation with industry stakeholders and legislators.

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REFERENCES

[1] Garg, R., Dang, S., & Gauba, P. E-Waste: A Concern. VSRD Int. J. Bio-Technol. Pharm. Sci, (2022) pp. 37-44.
[2] Mahat, H., Hashim, M., Nayan, N., Saleh, Y., & Norkhaidi, S. B. E-waste disposal awareness among the Malaysian community. Knowledge Management and E-Learning, vol 11, issue 3 (2019) pp. 393–408.
[3] Shad, K. M., Tan, Y. L., & Karim, M. E. Sustainable E-Waste Management in Malaysia: Lessons From Selected Countries. IIUM Law Journal, vol 28, issue 2 (2020) pp. 415–447.
[4] Azlan, R. M. D., Abd Razak, S. S., & A/P Indiran, L. Knowledge, Attitude and Practices on E-Waste Management among Business Students in A Public University. International Journal of Academic Research in Business and Social Sciences, vol 11, issue 8 (2021).
[5] Hamzah, T. A. A. T., Yahya, A. S. M., & Shafie, A. Knowledge, attitude, and practices on E-waste recycling among public in port dickson. Pertanika Journal of Social Sciences and Humanities, vol 28, issue 4 (2020) pp. 2731–2748.
[6] Halim, L., & Suharyanti, Y. E-Waste: Current Research and Future Perspective on Developing Countries. International Journal of Industrial Engineering and Engineering Management, vol 1, issue 2 (2019) pp. 25–42.
[7] Ankit, Saha, L., Kumar, V., Tiwari, J., Sweta, Rawat, S., Singh, J., & Bauddh, K. Electronic waste and their leachates impact on human health and environment: Global ecological threat and management. Environmental Technology and Innovation, vol 24, (2021).
[8] Statista. (2023). Global e-waste generation outlook 2030 | Statista. https://www.statista.com/statistics/1067081/generation-electronic-waste-globally-forecast/
[9] Jain, M., Kumar, D., Chaudhary, J., Kumar, S., Sharma, S., & Singh Verma, A. Review on E-waste management and its impact on the environment and society. Waste Management Bulletin, vol 1, issue 3 (2023) pp. 34–44.

[10] Juma, S. N., & Kagoya, S. M. An Assessment of Electronic Waste Knowledge, Attitude, Intentions, and Risk Perception of Sustainable Electronic Waste Management from a Developing Country Perspective. Business Management Review, vol 25, issue 2 (2022).
[11] Kariwala, P., Kandpal, S. D., Dixit, S., Singh, A. K., Pathak, A., & Singh, S. Knowledge, Attitude and Practices Regarding Electronic Waste (e-waste) Management Among Users of Electronic Equipments Living in Lucknow City. Indian Journal of Community Health, vol 35, issue 1 (2023) pp. 38–45.
[12] Mohamad, M., Omar, A. J., & Mohamad, A. Awareness of e-waste among youth in Malaysia, (2021). https://crim.utem.edu.my/wp-content/uploads/2022/09/168-341-3421.pdf
[13] Sofian, D. D., Hanafiah, M. M., Woon, K. S., & Hassan, F. M. Characteristics of consumer towards development of sustainable e-waste management in Malaysia. IOP Conference Series: Earth and Environmental Science, vol 1167, issue 1 (2023).
[14] Gilal, F. G., Shah, S. M. M., Adeel, S., Gilal, R. G., & Gilal, N. G. Consumer e-waste disposal behaviour: A systematic review and research agenda. International Journal of Consumer Studies, vol 46, issue 5 (2022) pp. 1785–1803.
[15] Aboelmaged, M. E-waste recycling behaviour: An integration of recycling habits into the theory of planned behaviour. Journal of Cleaner Production, vol 278, (2021) pp. 124182.
[16] Kumar, A. Exploring young adults' e-waste recycling behaviour using an extended theory of planned behaviour model: A cross-cultural study. Resources, Conservation and Recycling, vol 141, (2019) pp. 378–389.
[17] Arain, A. L., Pummill, R., Adu-Brimpong, J., Becker, S., Green, M., Ilardi, M., Van Dam, E., & Neitzel, R. L. Analysis of e-waste recycling behavior based on survey at a Midwestern US University. Waste Management, vol 105, (2020) pp. 119–127.
[18] Thukral, S., Shree, D., & Singhal, S. Consumer behaviour towards storage, disposal and recycling of e-waste: systematic review and future research prospects. Benchmarking: An International Journal, vol 30, issue 3 (2023) pp. 1021–1072.
[19] Adeel, S., Nayab, A., Qureshi, M. U., & Channa, K. A. University students' awareness of e-waste and its disposal practices in Pakistan: a construction of the conceptual framework. Journal of Material Cycles and Waste Management, vol 25, issue 4 (2023) pp. 2457–2470.
[20] Almulhim, A. I. Household's awareness and participation in sustainable electronic waste management practices in Saudi Arabia. Ain Shams Engineering Journal, vol 13, issue 4 (2022).
[21] Ananno, A. A., Masud, M. H., Dabnichki, P., Mahjabeen, M., & Chowdhury, S. A. Survey and analysis of consumers' behaviour for electronic waste management in Bangladesh. Journal of Environmental Management, vol 282, (2021) p. 111943.
[22] Attia, Y., Soori, P. K., & Ghaith, F. Analysis of households' e-waste awareness, disposal behavior, and estimation of potential waste mobile phones towards an effective e-waste management system in dubai. Toxics, vol 9, issue 10 (2021).
[23] Miner, K. J., Rampedi, I. T., Ifegbesan, A. P., & Machete, F. Survey on household awareness and willingness to participate in e-waste management in Jos, Plateau State, Nigeria. Sustainability (Switzerland), vol 12, issue 3 (2020) p. 1047.
[24] Goel, R., Sahai, S., & Singh, G. Consumer's Awareness and Perception Towards E-Waste Management. In C. Baskar, S. Ramakrishna, S. Baskar, R. Sharma, A. Chinnappan, & R. Sehrawat (Eds.), Handbook of Solid Waste Management: Sustainability through Circular Economy, Springer Singapore, (2020) pp. 1–11.
[25] Bhatia, A., Kiran, C., & Kapoor, M. Chhavi Kiran and Madhav Kapoor, a Study on Awareness of Consumers towards E-Waste Management in the City of Jaipur. International Journal of Management, vol 6, issue 2 (2019) pp. 200–208.
[26] Dhillon, J., & Sandhu, V. E-waste management strategy in organizations - A conceptual framework. Journal of Critical Reviews, vol 7, issue 1 (2020) pp. 373–380.
[27] Fischer, D., Seidu, F., Yang, J., Felten, M. K., Garus, C., Kraus, T., Fobil, J. N., & Kaifie, A. Health consequences for E-waste workers and bystanders—a comparative cross-sectional study. International Journal of Environmental Research and Public Health, vol 17, issue 5 (2020).

[28] Decharat, S., & Kiddee, P. Assessment of knowledge, attitude, perceptions and risk assessment among workers in e-waste recycling shops, Thailand. Environmental Health and Toxicology, vol 37, issue 1 (2022).
[29] Srivastava, R. R., & Pathak, P. Policy issues for efficient management of E-waste in developing countries. In M. N. V. Prasad, M. Vithanage, & A. Borthakur (Eds.), Handbook of Electronic Waste Management, Butterworth-Heinemann, (2020) pp. 81–99.
[30] Debnath, B., Chowdhury, R., & Ghosh, S. K. Sustainability of metal recovery from E-waste. Frontiers of Environmental Science & Engineering, vol 12, issue 6 (2018) p. 2.
[31] Patil, R. A., & Ramakrishna, S. A comprehensive analysis of e-waste legislation worldwide. Environmental Science and Pollution Research, vol 27, issue 13 (2020) pp. 14412–14431.
[32] Borthakur, A. Design, adoption and implementation of electronic waste policies in India. Environmental Science and Pollution Research, vol 30, issue 4 (2023) pp. 8672–8681.
[33] Yong, Y. S., Lim, Y. A., & Ilankoon, I. M. S. K. An analysis of electronic waste management strategies and recycling operations in Malaysia: Challenges and future prospects. Journal of Cleaner Production, vol 224, (2019) pp. 151–166.
[34] Rautela, R., Arya, S., Vishwakarma, S., Lee, J., Kim, K.-H., & Kumar, S. E-waste management and its effects on the environment and human health. Science of The Total Environment, vol 773, (2021) p. 145623.
[35] Gollakota, A. R. K., Gautam, S., & Shu, C.-M. Inconsistencies of e-waste management in developing nations – Facts and plausible solutions. Journal of Environmental Management, vol 261, (2020) p. 110234. https://doi.org/10.1016/j.jenvman.2020.110234
[36] Xavier, L. H., Ottoni, M., & Lepawsky, J. Circular economy and e-waste management in the Americas: Brazilian and Canadian frameworks. Journal of Cleaner Production, vol 297, (2021) p. 126570.
[37] Anuardo, R. G., Espuny, M., Costa, A. C. F., Espuny, A. L. G., Kazançoğlu, Y., Kandsamy, J., & de Oliveira, O. J. Transforming E-Waste into Opportunities: Driving Organizational Actions to Achieve Sustainable Development Goals. Sustainability (Switzerland), vol 15, issue 19 (2023).
[38] Krejcie, R.V. & Morgan, D.W. Determining sample size for research activities. Educational and Psychological Measurement, vol 30, (1970) pp. 607-610.

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