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ORIGINAL RESEARCH ARTICLE

The role of knowledge, awareness and environmental attitudes in green product management

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ABSTRACT

BACKGROUND AND OBJECTIVES: Manager involvement is very important in environmental protection. Since then, many managers have integrated environmental sustainability into their business strategies by adopting green practices that focus on green products. The aim of the current study is to examine the effect of environmental knowledge on green products and the mediating role of environmental awareness and environmentally friendly attitudes.

METHODS: This study used a structured questionnaire for collecting data, where respondents were asked to provide their responses to green products produced by environmentally friendly manufacturing companies. The partial least squares structural equation modeling was used to test and analyze the relationships in the proposed model.

FINDINGS: The results of the study explained that in order to create a green product, managers' awareness of the environment needs to be formed which can be realized by the presence of a number of knowledge about the environment. Thus, environmental awareness is a mediator between environmental knowledge and green products. However, an environmentally friendly attitude is not a mediator between environmental knowledge and green products.

CONCLUSION: Managers' awareness of the environment must be realized by sharing knowledge about the importance of protecting the environment because this will affect the production of green products.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
51	2	7

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INTRODUCTION

In the 21st century, there has been an increase in environmental problems. For this reason, companies are required to use balanced natural resources through responsible behavior from both the community and the business world, thus economic development can be achieved, and negative environmental impacts can be minimized from economic activities and obtain social welfare (Pinskaya *et al.*, 2021; Yumei *et al.*, 2021; Babenko *et al.,* 2019), which ultimately forms sustainable development. Popularity and priority of sustainable development in most business circles focused on human development and environmental protection (Gryshcenko *et al.,* 2022). Since then, more companies are integrating the environmental concerns in their business operations and in their interactions with stakeholders, embracing environmental sustainability into business strategies. Moreover, they are increasingly adopting green practices. The reason is to increase competitiveness and be social responsibility. The term of green is usually used to describe environmental protection and quality improvement (Raharjo, 2018; Xie *et al.*, 2019). Green practices in companies generally focus on clean technologies including cleaner production, eco-efficiency of materials, renewable energy technologies, and efficient energy utilization (Espinosa *et al.*, 2021; Hu *et al.*, 2022). Since the early 2000s, the focus of sustainable companies has shifted from the introduction of clean technologies to the production of green products (Fernando *et al.*, 2019). In general, green products are used to describe products that seek to maintain and protect the environment during the production process by conserving resources and minimizing waste and pollution (Sana, 2020; Ouhsine *et al.*, 2020). There were many studies on green products from a consumer perspective (Sharma and Foropon, 2019; Choi and Johnson, 2019; Redman, 2014; Kautish and Sharma, 2020; Bansal, 2011). However, Katsikeas *et al.*, 2016; Albino *et al*., 2009 have conducted quantitative research on the perceptions of company managers about green products. Green products are influenced by external influences from consumers. Nonetheless, internal influences such as knowledge, awareness, and attitude of managers towards green products cannot be neglected, as decisions made by managers that significantly affect the company's

image are coupled with the help of their subordinates. In addition, studies investigating the mediating role of environmental awareness and attitudes from a manager's point of view are still limited. Based on the description of previous studies, it can be seen that this research contributes to filling the gaps in the literature. Karatas and Gürbüz, 2016; Osman *et al.,* 2016 found that environmental awareness mediates the effect of environmental knowledge on environmentally friendly attitudes and green products viewed from the perspective of consumer. In contrast to the previous researches, the novelty of this research is investigating the environmentally friendly awareness and attitude which mediate the relationship between environmental knowledge and green products from the manager's perspective. The decision to produce products is the main focus and responsibility of the manager. Therefore, it is very important to further investigate the role of managers in green product. The development of green products requires environmental knowledge (Li *et al.,* 2019). Based on this, it is important for managers to have knowledge of the environment which consists of: systemic knowledge, knowledge related to action, and knowledge of benefits (effectiveness) (Geiger *et al.*, 2018). Systemic knowledge is knowledge of the existence of environmental problems. Action-related knowledge is knowledge of the impact of behavior on the environment and knowledge of benefits (effectiveness), knowledge of tools for how to reduce environmental impacts. It can be said that in order to overcome environmental problems, individual must first carry out systematic knowledge, where this knowledge analyzes before taking action and must have an understanding of the natural state of the ecosystem and the processes in it. Individual should not just overcome the environment which ultimately destroys the ecosystem of it. What can be done to overcome environmental problems is by doing some efforts to keep the environment, thus the benefits of environmental work process can be realized. Therefore, in carrying out activities, company managers must know the process of environmental knowledge which starts from the analysis, action, and benefits of environmental knowledge. In addition, environmental knowledge is the most important aspect of environmental awareness (Zsóka *et al.*, 2013; Zhan *et al.,* 2018). This means that with environmental knowledge possessed by individuals,

environmental awareness will be formed because the result of environmental knowledge is environmental protection science and insight that is useful for forming environmental awareness. Thus, individuals who have some environmental knowledge will be more concerned and sensitive to environmental damage compared to individuals who do not, thus, care and love for the environment does not appear. Environmental knowledge and awareness is very important for the prevention of environmental problems. To form environmental awareness, a multidimensional concept is needed which consists of cognitive, affective and conative components (Du *et al.*, 2019). The cognitive component is the basis for pro-environmental behavior because this component consists of environmental knowledge such as the ability to overcome environmental issues, the affective component of environmental awareness includes feelings or emotions expressed as well, bad, positive, negative, likes, dislikes, anger, not angry, and others. For example, individual will be frustrated and angry when the industry pollutes the environment. It can be said that the affective component as a predictor of pro-environmental behavior. Finally, the conative component of environmental awareness is behavioral intentions that contribute to solving environmental problems. In this study, environmental knowledge can be demonstrated through environmental behavior which is a component of cognitive and conative used as the basis for the formation of environmental awareness. This means that individuals who have environmental knowledge will have the ability to overcome environmental issues by creating green products and these products are used as a form of solving environmental problems shown through behavior. In accordance with the study conducted by Karatas and Gürbüz, 2016, which stated that if there were cases of damage to the natural environment, it is necessary to provide environmental knowledge, in order to form public awareness in overcoming environmental problems. Furthermore, environmental knowledge is the basis for generating positive environmental attitudes (Zsóka *et al.*, 2013). Another study also explained that environmental knowledge influences attitudes towards the natural environment (Tamar *et al.,* 2020; Liu *et al.,* 2020). Therefore, environmental knowledge becomes the main predictor to influence environmental attitudes. With the needs and desires

of consumers for green products, there is an awareness of managers to use environmentally friendly marketing strategies in order to get attractiveness from consumers on the products. Green products can be produced if there is environmental awareness from managers. This is in line with the finding by Kautish and Sharma, 2020, which revealed that people with a greater environmental awareness will have a big effort to prevent environmental exploitation and contribute to environmental sustainability, thus leading them to use green products. Furthermore, environmental awareness and environmental knowledge can lead to positive changes in environmental attitudes (Law *et al*., 2017). People with environmental knowledge and awareness can more easily present an environmentally friendly attitude (Chen *et al.,* 2015; Law *et al.,* 2017). The more people have a good attitude and make positive choices for the environment, the more likely they are to use an green products (Leroux and Pupion, 2018). Sreen *et al.,* 2020; Suki, 2016 have established a significant relationship between environmental attitudes towards green products. In addition to having a direct influence, environmental awareness also has an indirect influence (mediation). This is supported by studies conducted by Karatas and Gürbüz, 2016; Osman *et al*., 2016, which revealed that environmental awareness mediates the effect of environmental knowledge on environmentally friendly attitudes and green products. However, this kind of mediation has not been studied from a manager's perspective. Then an environmentally friendly attitude fully mediates the relationship between environmental knowledge and green products, which means that high environmental knowledge causes a positive attitude to the environment which will have an effect on green products (Binti Aman, 2011). Furthermore, environmentally friendly attitudes are also influenced by environmental awareness because environmental awareness has several components, such as, environmental knowledge, environmental values, and environmental attitudes (Fu *et al.*, 2017; Abdul-Wahab and Abdo, 2010). Therefore, an environmentally friendly attitude is a part of environmental awareness. People with an awareness of environmental protection will be indicated by a favorable attitude towards green products. Based on the description, the conceptual framework can be
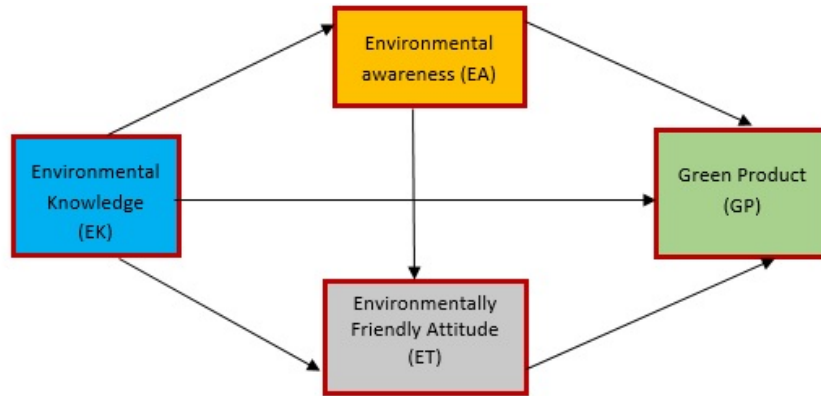
Fig. 1: The conceptual framework of research work

Table 1: Measurement method (questionnaire and scaling)

Variable	Indicators	Industry type	Source
Environmental knowledge	1-6	Manufacture	Fawehinmi *et al*., 2020
Environmental awareness	1-8	Manufacture	Cao and Chen, 2019
Environmentally friendly attitude	1-8	Manufacture	Safari *et al*., 2018; Adrita and Mohiuddin, 2020
Green product	1-7	Manufacture	Kong *et al*., 2016

proposed as shown in Fig. 1. The aim of the current study is to examine the effect of environmental knowledge on green products affected by knowledge, awareness, and environmentally friendly attitudes, thus providing important insights for business stakeholder in facilitating the development of green products. This research has been conducted in West Sumatera, Indonesia in 2021.

MATERIALS AND METHODS

The population of this study were managers of manufacturing companies in West Sumatera, Indonesia. The sample were 216 managers who were selected using purposive sampling technique. This study used partial-least-squares structural-equation-modeling (PLS-SEM) with the help of the Smart PLS statistical tool. The reason for using PLS-SEM is that this research is a predictive study and the additional characters in this study such as environmental awareness and environmentally friendly attitudes become mediators between environmental knowledge and green products. In addition, PLS-SEM is widely used because of its robustness by providing evidence of higher reliability and validity even in small sample studies (Henseler *et al*., 2009).

Measurement (questionnaire and scaling)

The questionnaire was developed based on several previous studies. The questionnaire was answered using a Likert scale ranging from strongly disagree with a score of 1 to strongly agree with a score of 5 in measuring each construct. The measurement of environmental knowledge was adopted from Fawehinmi *et al*., 2020, while the measurement of environmental awareness was adopted from Cao and Chen, 2019. Measurement of environmentally friendly attitude constructs was based on Safari *et al*., 2018; Adrita and Mohiuddin, 2020 and green product measurements were adopted from Kong *et al*., 2016. It can be seen in Table 1.

RESULTS AND DISCUSSIONS
Characteristic of respondents

The results showed that the most male respondents participated with a percentage of 53% while the rest were female respondents with a percentage of 47%. Meanwhile, when viewed from the age of the respondents, the age range of 40-45 years was the most dominant with the highest percentage of 65%. Furthermore, 56% of the respondents held a master's degree from a state university, 60% of respondents

worked as a production manager, and 70% of the respondents have worked for 15 years.

Measurement of model assesment

Smart PLS 3.0 was used to analyze the data (Ringle *et al.*, 2015). PLS-SEM uses two important stages, the measurement model and the structural model (Anderson and Gerbing, 1988; Henseler *et al.*, 2009). The analysis of the measurement model was used to determine the validity and the reliability of the data. The analysis of the measurement model consists of; 1) loading factor for each question item from each construct, 2) internal composite reliability, 3) average variance extracted (AVE) and 4) discriminant validity. The above models were used to evaluate the measurement model whose construct is reflective. In this study, all indicators were measured as reflective constructs. The measurement model had been analyzed based on partial-least-squares structural-equation-modeling, with the help of smart PLS 3.0 (Ringle *et al.*, 2015). Table 2 showed the results of the assessed measurement models. Table 2 showed

Table 2: Assesment result of measurement model

Construct	Indicator	Loading factor	Composite Reliability	AVE
EK	Know environmental issues	0.824	0.900	0.750
	Have good knowledge of environmental issues	0.874		
	Protect the environment from pollution	0.899		
EA	Provide a healthy work environment	0.812	0.929	0.687
	More concerned with the company environment	0.825		
	Designe an eco-friendly enterprise system	0.841		
	All members of the organization must design an environmentally friendly company system	0.861		
	Organization members are more concerned with the company's environment	0.853		
	Company reputation as an environmentally conscious organization	0.779		
ET	Working in an eco-friendly company is a positive	0.911	0.970	0.801
	Good image about implementing environmentally friendly behavior	0.880		
	Caring about the environmental consequences of behavior	0.900		
	Have strong feelings about eco-friendly behavior	0.885		
	Involvement in environmental activities will save the environment for future generations	0.921		
	It is important to promote eco-friendly living	0.891		
	More action is needed on environmental protection	0.880		
	It is important to increase environmental awareness	0.890		
GP	Produce quality products	0.844	0.886	0.722
	The resulting product is beneficial to the environment	0.881		
	Use product packaging materials that are safe for the environment	0.823		

Table 3: Discriminant validity (HTMT ratio

Constructs	GP	EA	EK	ET
GP				
EA	0.770			
EK	0.617	0.797		
ET	0.072	0.068	0.114	

the loading factor exceeding the recommended value of 0.7 (Hair *et al*., 2013). Furthermore, the results of composite reliability were higher than the recommended value of 0.6 and the AVE values were higher than the minimum criterion of 0.5 (Fornell and Larcker, 1981). Thus, the model built was categorized as good so that it provided adequate support. Based on the measurement validation analysis, all HTMT (heterotrait-monotrait) ratios were lower than the maximum threshold of 0.85 suggested by Henseler *et al*., 2015, as shown in Table 3. The analysis showed sufficient evidence for the discriminant validity of all constructs.

From Tables 2 and 3, it can be seen that the data of results met the requirements of the measurement model. Followed by structural model analysis, the point is to test the tested hypotheses through significance, path coefficients, and t-statistics as well as estimate the mediation model.

Structural model assesment

In accordance with the purpose of this study as stated in Fig. 1, to assess the direct effect and indirect

effect (mediation), structural model analysis was used. This study had six direct hypotheses. Three hypotheses were accepted (H1; H2; H4) because the p-value was less than 0.05 but (H3; H5; H6) was rejected because the p-value is more than 0.05 as shown in Fig. 2 and Table 4.

Then, to test the mediating effect, the PLS-SEM bootstrap technique was applied (Hair *et al*., 2010), which can be done by re-sampling five hundred samples (Ringle *et al*., 2015). As revealed by Chin *et al*., 2003, PLS can provide a more accurate estimate of the mediating effect by taking into account errors that weaken the predicted relationship and increase theory validation (Helm *et al*., 2010). Table 5 showed the results of the mediation analysis. The mediating effect was only found in H7a because the p values were smaller than 0.05 but the hypothesis of H7b; H8a; H8b were rejected because the p values were greater than 0.05 which can be seen in Fig. 2. Therefore, environmental awareness and environmentally friendly attitudes did not mediate the relationship between environmental knowledge of green products in manufacturing companies in
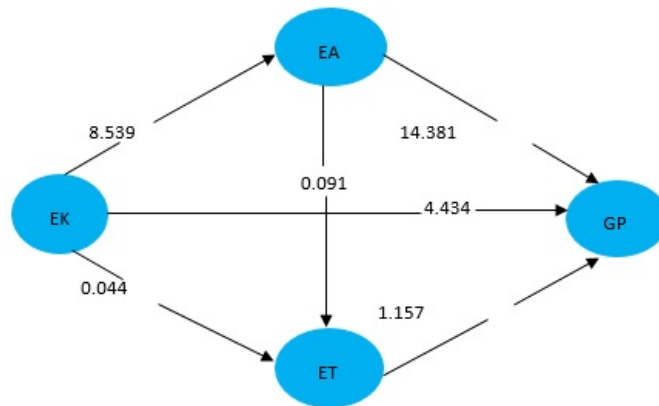

Fig. 2: Direct effects, structural model assessment. It mainly showed the t-value and path coefficient for accepting or rejecting the hypothesis

Table 4: Structural model assesment (direct effect result and decision)

Hypo thesis	Relationship	Original sample (O)	Average sample (M)	SD	T Statistic (|O/S.D.)	P- values	Decision
H1	EK-> GP	0.298	0.295	0.067	4.434	0.000	Accepted
H2	EK -> EA	0.694	0.699	0.048	14.381	0.000	Accepted
H3	EK -> ET	0.117	0.110	0.101	1.157	0.248	Rejected
H4	EA -> GP	0.543	0.547	0.064	8.539	0.000	Accepted
H5	EA -> ET	0.010	0.010	0.108	0.091	0.927	Rejected
H6	ET -> GP	0.002	0.004	0.044	0.044	0.965	Rejected

West Sumatera, Indonesia.

Table 6 showed the value of R Square (R^2). Testing the value of R^2 aimed to see how the independent variable is able to describe the dependent variable. In this study, the contribution given by environmental knowledge to environmental awareness was 48.2%, then the contribution given by environmental knowledge and environmental awareness to environmentally friendly attitudes was 1.2%. Finally, the contribution made by environmental knowledge, environmental awareness, and environmentally friendly attitudes towards green products was 60.7%.

In addition, the effect size (F^2) for each path model was calculated. Table 7 showed the output of the effect size (F^2). The value of F^2 can be interpreted whether the predictor variable had a weak, moderate or strong influence on the structural level. If the value of F^2 was 0.02 then it had a weak effect, while 0.15 had a moderate effect and a value of 0.35 had a strong influence (Hair *et al*., 2010). Based on Table 7, it indicated that environmental awareness had a strong influence on green products and environmental knowledge had a strong influence on environmental awareness.

Direct effect

Environmental knowledge had a significant direct impact on green products. These findings were in line with Li *et al*., 2019. Respondents' perception of protecting the environment from pollution was very high which can be seen in Table 2, meaning that manufacturing managers will use some of their ecological knowledge in the production process thus contributing to environmental improvement such as protecting the environment from pollution in various actions. Similarly, environmental knowledge had a significant direct impact on environmental awareness. The results of this study were in accordance with Zsóka *et al*., 2013; Zhan *et al*., 2018; Karatas and Gürbüz, 2016. To increase environmental awareness, the company must pay attention to the flow of knowledge and environmental learning. Furthermore, environmental awareness had a significant direct impact on green products. These findings supported research conducted by Kautish and Sharma, 2020, which stated that environmental awareness significantly affected green products from the consumer's point of view. From the producer side, it also explained that the manager's perception

Table 5: Structural model assesment (indirect effect result and decision)

Hypothesis	Relationship	Original Sample (O)	Average sample (M)	S.D.	T Statistik ($|$O/S.D.$|$)	P- values	Decision
H7a	EK -> EA -> GP	0.377	0.379	0.052	7.221	0.000	Accepted
H7b	EK -> EA -> ET	0.007	0.004	0.079	0.086	0.931	Rejected
H8a	EK -> ET -> GP	0.000	0.000	0.007	0.033	0.974	Rejected
H8b	EA -> ET -> GP	0.000	0.000	0.004	0.004	0.997	Rejected

Table 6: R square (R^2)

Construct	R square	Adjusted R square
GP	0.607	0.601
EA	0.482	0.479
ET	0.012	0.002

Table 7: Effect size (F^2)

R—squared	Fsquared	Effect size F^2
EK—–> GP	0.116	Weak
EA—–> GP	0.389	Strong
ET—–> GP	0.000	Weak
EK —–> EA	0.930	Strong
EK —–> ET	0.007	Weak
EA—–> ET	0.000	Weak

of environmental awareness was very high which can be seen in Table 2, all company members must design environmentally friendly company products, meaning that managers' awareness of designing green products was very high, thus, it had an impact on increasing the production of green products. Furthermore, the results of this study indicated that environmental knowledge had no significant effect on environmentally friendly attitudes. It indicated that the ecological knowledge did not lead to attitudes which can be beneficial to the environment. These findings were supported by Paço and Lavrador, 2017; who found that despite a high level of environmental knowledge, individuals did not show positive environmental attitudes. This finding contrasted with empirical studies conducted by Tamar *et al*., 2020; Liu *et al*., 2020 which showed that environmental knowledge had a significant effect on environmentally friendly attitudes. The explanation of this case is that environmental knowledge results from the learning process does not lead managers to an understanding of moral values towards the environment. Furthermore, the purpose of obtaining environmental knowledge is not only mastering environmental knowledge but also implementing moral values on the environment, if managers can find moral values for the environment from a subject matter being studied, they can make more efforts and certain sacrifices by showing a positive attitude towards the environment. Thus, environmental knowledge did not affect the attitude of managers in protecting the environment. Then this study found that environmental awareness had an insignificant effect on environmentally friendly attitudes. The thing that causes this research to be insignificant is known from the lack of understanding of the theory of environmental awareness shown in the environmental awareness indicators with item statement number one and two, namely the company had a positive effect on the environment and can make energy savings, where this item is excluded in the research model because the invalidity of the statement item, thus, the manager's awareness of the environment is weak. Therefore, environmental awareness did not have an important role in being environmentally friendly. The results of this study were in accordance with study by Mustikaningrum, 2018 which stated that environmental awareness had a negative and insignificant effect on environmentally friendly attitudes but contrasted with research conducted by Chen *et al*., 2015; Law *et*

al., 2017, who found that environmental awareness was an important determinant of environmental issues, attitudes, and responsibilities. Furthermore, the finding showed that environmentally friendly attitudes had no significant effect on green products. The results of this study implied that there was a little availability of green products because the synergy of the presence of environmentally friendly companies in building positive attitudes related to the environment is relatively low in developing countries, especially in West Sumatera, Indonesia, compared to developed industrial countries. The results of this study were not in line with research conducted by Sreen *et al*., 2020; Suki, 2016, which explained that there was a significant relationship between favorable attitudes towards green products.

Indirect effect (mediating effect)

This finding also explained that environmental awareness mediated the relationship between environmental knowledge and green products (H7a). It indicated that environmental knowledge must be implemented to form awareness of the importance of environmental protection which can encourage company managers to increase the production of green products. This was confirmed by Karatas and Gürbüz, 2016; Osman *et al*., 2016, who explained that environmental knowledge had a significant positive effect on green products through environmental awareness. Furthermore, environmental awareness did not mediate the relationship between environmental knowledge and environmentally friendly attitudes (H7b), environmentally friendly attitudes did not mediate the relationship between environmental knowledge on green products (H8a), and environmentally friendly attitudes did not mediate the relationship between environmental awareness and green products (H8b). The results of this study were in line with research carried out by Hansla *et al*., 2008, which stated that an environmentally friendly attitude was not a mediator variable. In short, environmental awareness was an important mediation in explaining the relationship between environmental knowledge and green product based on company managers.

CONCLUSION

Managers' awareness of the environment must be realized by sharing knowledge about the importance of protecting the environment because this will affect

the production of green products. Environmental awareness had an important role in explaining the relationship between environmental knowledge and green products from the perspective of manufacturing managers. Thus, the effort to increase the production of green products was the building of manager awareness by sharing knowledge and learning about the importance of protecting the environment. From these findings, a number of managerial implications can be suggested as manufacturing companies must increase the production of green products properly, thus, they are not harmful for human health or environment. In the future, the majority of companies will go green, so manufacturing companies must follow this trend by making a "green manufacturing" where the products must be subject to the preservation of nature and the environment. Becoming a green manufacturing can be a step to compete with other companies. Therefore, manufacturing businesses must demonstrate their awareness of environmental protection by starting with various environmental actions and services to reduce waste, use of energy and water, and other consumption. Then, it is very important for environmentally friendly manufacturing companies to get an environmental certificate by showing that environmental programs are being implemented, this will certainly help improve the company's image which will ultimately lead to business improvement. More importantly, manufacturing managers must clearly show their true motives for the process of green product, otherwise they will put themselves at risk of being accused of "greenwashing". They are also advised to ensure that every production process must be properly proven and accompanied by evidence. However, this study has some limitations and it is suggested for further research to improve it. First, this research was only conducted in West Sumatera, Indonesia. Therefore, it cannot be generalized to other countries. For further research, it is recommended to expand this research, such as comparing developed countries with developing countries in the process of green products. Second, this research is included in the category of cross sectional research so that it has limitations in explaining the findings. For this reason, it is recommended for further research to conduct research included in the category of longitudinal research. Third, this study only analyzed environmental knowledge, awareness and environmentally friendly attitudes in an effort to increase green product production. Therefore, further research can add institutional support, managers' intentions and behavior in producing green products to support the findings of this study.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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ABBREVIATIONS

%	Percent
—–>	Arrow symbol
AM	Average sample
AVE	Average variance extracted
EA	Environmental awareness
EK	Environmental knowledge
ET	Environmental attitude
et al.	Et alia
FE	Fixed effect
Fig.	Figure
GP	Green product
H1	Hypothesis 1
H2	Hypothesis 2
H3	Hypothesis 3
H4	Hypothesis 4
H5	Hypothesis 5
H6	Hypothesis 6
H7	Hypothesis 7
H8	Hypothesis 8
HTMT	Heterotrait monotrait
i.e.	Id est
O	Original sample
P-value	Probability value
PLS-SEM	Partial least square-structural equation model
R-Square (R²)	Determination coefficient
S.D.	Standard deviation
T-statistic	Hypothesis tets statistic
VB-SEM	Variance based-structural equation model

REFERENCES

Abdul-Wahab, S.A.; Abdo, J., (2010). The effects of demographic factors on the environmental awareness of Omani citizens. Hum. Ecol. Risk Assess., 16(2): 380–401 **(22 pages).**

Adrita, U.W.; Mohiuddin, M.F., (2020). Impact of opportunity and ability to translate environmental attitude into ecologically conscious consumer behavior. J. Mark. Theory Pract., 28(2): 173–186 **(14 pages)**.

Albino, V.; Balice, A.; Dangelico, R.M., (2009). Environmental strategies and green product development: an overview on sustainability-driven companies. Bus. Strategy Environ., 18(2): 83–96 **(14 pages).**

Anderson, J.C.; Gerbing, D.W., (1988). Structural equation modeling in practice: A review and recommended two-step approach. Psychol. Bull., 103(3): 411-423 **(13 pages)**.

Babenko, V.; Perevozova, I.; Mandych, O.; Kvyatko, T.; Maliy, O.; Mykolenko, I., (2019). World informatization in conditions of international globalization: Factors of influence. Global J. Environ. Sci. Manage., 5 (Special Issue): 172-179 **(8 pages).**

Bansal, G., (2011). E-book usage: role of environmental consciousness, personality and past usage. J. Comput. Inf. Syst., 52(2): 93–104 **(12 pages)**.

Binti Aman, A.H.L., (2011). The influence of environmental knowledge and concern on green purchase intention: the role of attitude as mediating variable. Thesis, Universiti Malaysia Sabah, Malaysia.

Cao, H.; Chen, Z., (2019). The driving effect of internal and external environment on green innovation strategy-The moderating role of top management's environmental awareness. Nankai Bus. Rev. Int., 10(2): 342-361 **(20 pages).**

Chen, X.; Chan, D.Y.C.; Wei, C.H., (2015). The research on environmental conscious and Green Consumption Behavior in China. Serv. Sci. Manage., 40(4): 30–36 **(7 pages)**.

Chin, W.W.; Marcolin, B.L.; Newsted, P.R., (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. Inf. Syst. Res., 14(2): 189–217 **(29 pages).**

Choi, D.; Johnson, K.K.P., (2019). Influences of environmental and hedonic motivations on intention to purchase green products: An extension of the theory of planned behavior. Sustain. Prod. Consump., 18(3): 145-155 **(11 pages)**.

Du, Y.; Wang, X.; Zhang, L.; Feger, K.H.; Popp, J.; Sharpley, A., (2019). Multi-stakeholders' preference for best management practices based on environmental awareness. J. Clean. Prod., 236, 117682.

Espinosa, R.V.; Soto, M.; Garcia, M.V.; Naranjo, J.E., (2021). Challenges of implementing cleaner production strategies in the food and beverage industry: literature review. Adv. Appl. Comp. Sci., Elect. Ind. Eng., 121–133 **(13 pages)**.

Fawehinmi, O.; Yusliza, M.Y.; Kasim, W.Z.W.; Mohamad, Z., (2020). Exploring the interplay of green human resource management, employee green behavior, and personal moral norms. SAGE Open, 10(4): 1-18 **(18 pages)**.

Fernando, Y.; Jabbour, C.J.C.; Wah, W.-X., (2019). Pursuing green growth in technology firms through the connections between environmental innovation and sustainable business performance: does service capability matter? Resour. Conserv. Recycl., 141 (2-3): 8–20 **(13 pages)**.

Fornell, C.; Larcker, D.F., (1981). Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res., 18(1): 39–50 **(12 pages)**.

Fu, L.; Zhang, Y.; Bai, Y., (2017). Pro-environmental awareness and behaviors on campus: Evidence from Tianjin, China. Eurasia J. Math. Sci. Technol. Educ., 14(1): 427–445 **(19 pages)**.

Geiger, S.M.; Dombois, C.; Funke, J., (2018). The role of environmental knowledge and attitude: Predictors for ecological behavior across cultures. An Analysis of Argentinean and German Students. Umweltpsychologie, 22(1): 69–87 **(19 pages).**

Gryshcenko, O.; Babenko, V.; Bilovodska, O.; Voronkova, T.; Ponomarenko, I.; Shatskaya, Z., (2022). Green tourism business as marketing perspective in environmental management. Global J. Environ. Sci. Manage. 8(1): 117-132 **(16 pages).**

Hair, J.F.; Sarstedt, M.; Ringle, C.M.; Mena, J.A., (2013). An assessment of the use of partial least squares structural equation modeling in marketing research. J. Acad. Mark. Sci., 40(3): 414–433 **(20 pages)**.

Hair, J.F.; Black, W.C.; Babin, B.J.; Anderson, R.E., (2010). SEM: An introduction. Multivariate Data Analysis: A Global Perspective, 7th edition. Pearson Education, Upper Saddle River.

Hansla, A.; Gamble, A.; Juliusson, A.; Gärling, T., (2008). Psychological determinants of attitude towards and willingness to pay for green electricity. Energy Policy, 36(2): 768–774 **(7 pages)**.

Helm, S.; Eggert, A.; Garnefeld, I., (2010). Modeling the impact of corporate reputation on customer satisfaction and loyalty using partial least squares. In Handbook of partial least squares. Springer, Berlin, Heidelberg. 515–534 **(20 pages)**.

Henseler, J.; Ringle, C.M.; Sarstedt, M., (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. J. Acad. Mark. Sci., 43(1): 115–135 **(21 pages)**.

Henseler, J.; Ringle, C.M.; Sinkovics, R.R., (2009). The use of partial least squares path modeling in international marketing. Advances in international marketing. Emerald Group Publishing Limited, 2: 277-319 **(43 pages).**

Hu, R.; Shahzad, F.; Abbas, A.; Liu, X., (2022). Decoupling the influence of eco-sustainability motivations in the adoption of the green industrial IoT and the impact of advanced manufacturing technologies. J. Clean. Prod., 339, 130708.

Karatas, A.; Gürbüz, O.A., (2016). Environmental education as a tool for increasing environmental awareness of vocational school students. The Anthropologist, 23(3): 378–384 **(7 pages).**

Katsikeas, C.S.; Leonidou, C.N.; Zeriti, A., (2016). Eco-friendly product development strategy: antecedents, outcomes, and contingent effects. J. Acad. Mark. Sci., 44(6): 660–684 **(25 pages).**Kautish, P.; Sharma, R., (2020). Determinants of pro-environmental behavior and environmentally conscious consumer behavior: An empirical investigation from emerging market. Bus. Strategy Dev., 3(1): 112–127 **(16 pages)**.

Kong, T.; Feng, T.; Ye, C., (2016). Advanced manufacturing technologies and green innovation: The role of internal environmental collaboration. Sustainability, 8(10): 1056.

Law, M.M.S.; Hills, P.; Hau, B.C.H., (2017). Engaging employees in sustainable development–a case study of environmental education and awareness training in Hong Kong. Bus. Strategy Environ., 26(1): 84–97 **(14 pages)**.

Leroux, E.; Pupion, P.C., (2018). Factors of adoption of eco-labelling in hotel industry. Technol. Forecasting Soc. Change, 129: 194–209 **(16 pages)**.

Li, J.; Zhang, J.; Zhang, D.; Ji, Q., (2019). Does gender inequality affect household green consumption behaviour in China? Energy Policy, 135, 111071.

Liu, P.; Teng, M.; Han, C., (2020). How does environmental knowledge translate into pro-environmental behaviors?: The mediating role of environmental attitudes and behavioral intentions. Sci. Total Environ., 728, 138126.

Mustikaningrum, H., (2018). The effect of environmental awareness on consumer behavior of eco-friendly products mediated by eco-friendly attitude. Russ. J. Agricult. Socio-Econ. Sci., 79(7): 270 - 278 **(9 pages)**.

Osman, A.; Othman, Y.H.; Salahudin, S.N.; Abdullah, M.S., (2016). The awareness and implementation of green concepts in marketing mix: A case of Malaysia. Procedia Econ. Finance. 35: 428–433 **(6 pages)**.

Ouhsine, O.; Ouigmane, A.; Layati, El.; Aba, B.; Isaifan, R.; Berkani, M., (2020). Impact of COVID-19 on the qualitative and quantitative aspect of household solid waste. Global J. Environ. Sci. Manage., Special Issue (Covid-19), 6: 41-52 **(10 pages).**

Paço, A.; Lavrador, T., (2017). Environmental knowledge and attitudes and behaviours towards energy consumption. J. Environ. Manage., 197: 384–392 **(9 pages)**.

Pinskaya, M.; Meleshchenko, O.; Kovalchuk, O.; Karpenko, O.; Kompanets, E., (2021). Modelling the impact of environmental responsibility on the development of enterprises. Global J. Environ. Sci. Manage., 7(4): 503-522 **(20 pages)**.

Raharjo, K., (2018). The role of green management in creating sustainability performance on the small and medium enterprises. Manage. Environ. Qual., 30(3): 557-577 **(21 pages).**

Redman, E.; Redman, A., (2014). Transforming sustainable food and waste behaviors by realigning domains of knowledge in our education system. J. Clean. Prod., 64: 147–157 **(11 pages)**.

Ringle, C.; Da Silva, D.; Bido, D., (2015). Structural Equation Modeling with the Smartpls. Braz. J. Mark., 13(2): 56-72 **(13 pages).**

Safari, A.; Salehzadeh, R.; Panahi, R.; Abolghasemian, S., (2018). Multiple pathways linking environmental knowledge and awareness to employees' green behavior. Corp. Gov., 18(1): 81–103 **(23 pages)**.

Sana, S.S., (2020). Price competition between green and non green products under corporate social responsible firm. J. Retail. Consum. Serv., 55: 102118.

Sharma, A.; Foropon, C., (2019). Green product attributes and green purchase behavior: A theory of planned behavior perspective with implications for circular economy. Manage. Decis., 57(4): 1018-1042 **(25 pages).**

Sreen, N.; Purbey, S.; Sadarangani, P., (2020). Understanding the relationship between different facets of materialism and attitude toward green products. J. Global Mark., 33(5): 396–416 **(21 pages)**.

Suki, N.M., (2016). Green product purchase intention: impact of green brands, attitude, and knowledge. Br. Food J., 118(12): 2893-2910 **(18 pages).**

Tamar, M.; Wirawan, H.; Arfah, T.; Putri, R.P.S., (2020). Predicting pro-environmental behaviours: the role of environmental values, attitudes and knowledge. Manage. Environ. Qual., 31:1-16 **(16 pages).**

Xie, X.; Huo, J.; Zou, H., (2019). Green process innovation, green product innovation, and corporate financial performance: A content analysis method. J. Bus. Res., 101: 697-706 **(10 pages).**

Yumei, H.; Iqbal, W.; Nurunnabi, M.; Abbas, M.; Jingde, W.; Chaudhry, I.S., (2021). Nexus between corporate social responsibility and firm's perceived performance: evidence from SME sector of developing economies. Environ. Sci. Pollut. Res., 28(2): 2132–2145 **(8 pages)**.

Zhan, Y.; Tan, K.H.; Ji, G.; Chung, L.; Chiu, A.S.F., (2018). Green and lean sustainable development path in China: Guanxi, practices and performance. Resour. Conserv. Recycl., 128: 240–249 **(10 pages)**.

Zsóka, Á.; Szerényi, Z.M.; Széchy, A.; Kocsis, T., (2013). Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. J. Clean. Prod., 48: 126–138 **(13 pages)**.

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