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Fostering eco-innovative behaviour among Malaysian SMEs: The role of leaders' green awareness and knowledge sharing practices

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Abstract

Aim: This study investigated the indirect effect of sustainable leadership (SL) on employees' eco-friendly innovative behaviour (EIB) through green knowledge sharing (GKS). It also examined whether leaders' green awareness (GA) amplifies the main effect of SL on GKS.

Methodology: Grounded in social learning theory and social exchange theory, data were collected from 283 employees working in Malaysian manufacturing SMEs through a cross-sectional survey. Partial least squares structural equation modelling (PLS-SEM) was employed to test the hypotheses.

Results: The results reveal that SL does not directly predict EIB. Instead, GKS serves as a significant mediator between SL and EIB. Furthermore, GA does not moderate the relationship between SL and GKS.

Implications and recommendations: These findings highlighted the critical role of knowledge-sharing practices in enabling eco-friendly innovation within SMEs. Managers should prioritise fostering green knowledge sharing rather than relying solely on leadership style. Future studies should explore cultural contingencies and alternative moderating variables that may strengthen the SL-EIB relationship.

Originality/value: This research contributes to green innovation theory by integrating two theoretical perspectives, testing a novel moderated-mediation framework, and examining the role of SL, GKS, and GA in a Malaysian SME context. It offers valuable insights into how leadership practices translate – or fail to do so – into employees' eco-innovation.

Keywords: eco-innovation, environmental sustainability, social learning theory, social exchange theory

1. Introduction

The rise in economic activities in developing countries has led to increased energy consumption and demand for goods and services. Unfortunately, this heightened demand has often resulted in environmental degradation and negative impacts on natural resources and ecosystems. Furthermore, previous research revealed that despite the implementation of environmental policies, legal regulations, and economic tools in many developing countries, the environmental condition continues to deteriorate (Zhao et al., 2022). Organizations located in these countries, where SMEs dominate (Iqbal & Piwowar-Sulej, 2023b), deal with environmental challenges to an extent never seen before. At the same time various stakeholders exert considerable pressure on them to become more environmentally sustainable (Jakhar et al., 2020). Eco-innovation, which is a specialised form of innovation that focuses on developing products and production processes with the goal of minimising their impact on the natural environment, has been found to be an effective means to achieve not only environmental (Ghimire et al., 2023) but also social and economic goals (Szilagyi et al., 2018) and positively impacts company competitive advantage (Li et al., 2023). One of the types of extra-role (voluntary) eco-friendly behaviour, related to the creation and implementation of novel and practical eco-friendly concepts (Chen & Chang, 2013), is eco-friendly (or green) innovative behaviour (EIB) (Aboramadan et al., 2021), which enables the creation and implementation of eco-innovation. Although numerous articles have focused on the issue of development and assessment of employees' environmentally-friendly modes of behaviour (e.g. (Unsworth et al., 2021; J. Zhang et al., 2021)), research on EIB is scarce (Piwowar-Sulej et al., 2023), hence this study aimed to fill this research gap.

Although green HRM practices have been shown as highly effective in stimulating employees' green behaviour (Piwowar-Sulej et al., 2023; Xie et al., 2023) also in developing countries such as Malaysia (Fawehinmi et al., 2020; Noor Faezah et al., 2024), SMEs rarely have HR departments to shape a complex HRM system. The role of leaders in SMEs is utmost importance as they have direct day-to-day contact with employees, influencing their motivation, attitudes and behaviour (Hossin et al., 2022). It has been demonstrated that leaders, through the use of two major forms of support, i.e. emotional – 'soft', and instrumental – 'technical', can encourage employees to behave in an environmentally-friendly way (Paillé et al., 2022). The extant literature also provided evidence that charismatic value-based leadership (Tuan, 2019), environmentally-specific servant leadership (Tuan, 2020), transformational leadership (Crucke et al., 2021), spiritual leadership (Anser et al., 2021) and ethical leadership (Nemr & Liu, 2021) enhance employees' broadly defined green behaviour, however fewer studies exists on the impact of leadership styles on EIB (Xu et al., 2022). There is also an emerging type of leadership, namely sustainable leadership (SL), which expresses true concern about the influence of human behaviour, focuses on a wide organizational stakeholder group as well as drives at organizations' achievements in environment, society and the economy (Piwowar-Sulej & Iqbal, 2023)[1]. This type of leadership has been linked with general employee innovation (Javed et al., 2021) but has not been examined in terms of employees' EIB before, which constitutes a promising gap to be filled by this study.

The article's aim was to integrate SL and employees' innovative eco-friendly behaviour research and examine the influence of SL on EIB. Based on the social learning theory (SLT) (Bandura, 1989) it is

[1] The overlapping and distinctive features of SL, in comparison to other leadership styles identified in the literature, were presented by Iqbal and Piwowar-Sulej (2023a). SL draws inspiration from servant leadership (by prioritising the fulfillment of a company's stakeholders' needs over personal interests), transformational leadership (by practicing idealised influence, inspirational motivation, intellectual stimulation, and individualised consideration), ethical leadership (by promoting ethical conduct through reinforcement, two-way communication, and decision-making), spiritual leadership (by embodying integrity, honesty, and humility, as well as creating themselves as someone who can be trusted) and shared leadership (by distributing leadership roles through employee participation and empowerment). However, it is the only leadership style that prioritises the needs of all company stakeholders, while balancing economic, environmental, and social organizational goals.

expected that sustainable leaders, who assist their team members in recognisings and exploiting green opportunities and thus motivate employees to engage in eco-friendly innovative activities, will become a role model for employees. Nonetheless, in view of the recent call for further investigation into the mediating mechanisms by which leadership influences employees' environmentally-friendly behaviour and the circumstances that amplify or diminish such effect (Afsar et al., 2020), the author examined the mediating role of green knowledge sharing (GKS). Green (environmental) knowledge – which can be treated as a fuel of eco-innovative behaviour – is associated with the employee's ability to recognise various concepts, symbols, and behavioural attributes associated with environmental conservation (Vicente-Molina et al., 2013). In turn, GKS can be described as a process where individuals share their environmental knowledge with others, promoting their learning, inspiring further exploration, and ultimately generating synergy (Jinliang et al., 2023). Drawing on the social exchange theory (SET) (Blau, 1964), which posits that individuals who receive resources from others feel a sense of obligation towards them, it is reasonable to anticipate that employees will display positive organizational behaviour. Employees provided by their leader with a source of environmental knowledge through GKS can more easily internalise environmental values and show reciprocated behaviour helping their companies to achieve environmental goals. In this case, EIB is treated as a product of exchange.

This study also investigated leaders' green (environmental) awareness (GA) as a crucial conditional factor of the SL-GKS relationship. GA, as an emerging, important research category in the field of human-environmental relations that needs further exploration (Płatkowska-Prokopczyk, 2017), is associated with concern and/or perception that determines an individual's information and knowledge (having a comprehension that the environment is fragile and acknowledging the significance of preserving it), as well as a propensity towards eco-friendly modes of behaviour, attitudes and attempts (Darvishmotevali & Altinay, 2022). As Roscoe et al. (2019) stated, individuals who possess a deeper understanding of the environment are more likely to actively participate in environmental activities such as GKS. Sustainable leaders, who simultaneously care about the economic and social outcomes of their companies, represent different levels of GA, therefore GA can affect the relationship between SL and GKS.

In terms of geographical context, the study used data collected from Malaysian SMEs operating in the manufacturing sector. The Association of South-East Asian Nations (ASEAN) region is highly dependent on their manufacturing industry which is also being reported as a source of high carbon emission, air and sea pollution (Hara, 2018). Although ASEAN members show their strong concern towards sustainable development goals, their manufacturing sector appears to be an obstacle in their accomplishment. According to Anbumozhi (2017), it is difficult for this region's businesses to transform their operations in order to bring significant positive effects on their carbon emission and sustainable use of resources at hand. What is more, SMEs are crucial for the economic development of Malaysia, a newly industrialised country and an emerging upper middle-income economy, constituting approximately 98.50% of the total number of companies. Moreover, manufacturing companies are drivers of job creation with results from 3 to 5 times higher than in the service sector (Iqbal et al., 2020). Earlier research on green behaviour in Malaysia focused on consumers (e.g. (Jahari et al., 2022)) and employees from universities (Fawehinmi et al., 2020; Noor Faezah et al., 2024). Additionally, Malaysia has a collectivist culture that emphasises helpfulness, compliance, reliance, and interactive relationships, and has a high power distance, meaning that society accepts a hierarchical order (Haq, 2020). The cultural context is crucial for understanding how SLT and SET function. In collectivist, high power distance cultures such as Malaysia, learning and social exchanges tend to be more hierarchical, group-oriented, and driven by duty rather than personal benefit. Leaders play a critical role in shaping behaviour, and individuals are more likely to conform to social norms rather than engage in open, negotiated exchanges. Given this context, the authors chose to focus on Malaysian manufacturing SMEs.

This research makes several contributions to the existing literature. Firstly, it enhances the current body of knowledge on employees' green behaviour by providing essential antecedents, extending the limited empirical evidence on the effect of SL on EIB. Additionally, it contributes to theory development by integrating two theoretical perspectives: the social learning theory and the social exchange theory

in the context of a high collectivist and hierarchy-oriented culture of Malaysia. Hence, it also answers the recent suggestion of Iqbal and Piwowar-Sulej (2023a) to combine these theories in order to increase the understanding of coexisting ways of explaining employee behaviour. Moreover, it also highlights a potential intervening mechanism in the form of GKS. Finally, the authors explored the moderating role of leaders' GA on the relationship between SL and GKS, thus fulfilling the postulate in Pellegrini et al. (2020) to conduct more research on effective leadership behaviour in order to develop knowledge sharing in organizations.

2. Establishment of theoretical framework and formulation of hypotheses

2.1. Brief description of theories used in this study

The first theory applied in this article was the social learning theory (SLT), which posits that individuals acquire knowledge and skills by observing the actions of others (models), including their coworkers. However, in high power distance cultures, individuals are more likely to follow the behaviour of authoritative figures such as leaders. Learning occurs through strict adherence to hierarchical norms, with subordinates closely observing their superiors (Daniels & Greguras, 2014), and also the effects of their behaviour, whether it has positive or negative consequences and follow it, which may give them benefits (Bandura, 1989). Note that in the early leadership research, followers were considered mere recipients, whereas now it is assumed that in fact they monitor leaders' behaviour, and identify effective or ineffective leaders in the context of the achievement of the common good, and that being a follower is a voluntary action (Almeida et al., 2021). People follow leaders, who in turn follow the common goals as sustainable leaders do, therefore employees learn and imitate the behaviour of sustainable leaders – including innovative eco-friendly activities. Furthermore, collectivist cultures emphasise learning within groups (Aktaş, 2012), meaning that modes of behaviour adopted by one individual are likely to be mirrored by others to maintain harmony and cohesion.

Researchers also widely use SET to increase the understanding of factors that impact on employees' behavioru. This theory suggests that behaviour is the outcome of the interactions of two parties who conduct a cost-benefit analysis to determine the risks and benefits resulting from that behaviour (Roeckelein, 2006). Voluntary exchanges of resources between parties include tangible (e.g. money), socio-emotional (e.g. trust or social support) and impersonal (e.g. transfer of knowledge) resources (Scheuer et al., 2021). If employees experience benefits from the company including, for example, a resource in the form of caring treatment by a leader or positive behaviours of coworkers, such as knowledge sharing, they will reciprocate engagement in companies' activities, which in this case means EIBs. However, rather than a balanced, negotiated exchange, relationships in high power distance cultures are shaped by duty, loyalty, and long-term commitments. Employees may feel obligated to contribute, providing loyalty and hard work in return for security, protection, and guidance from leaders rather than direct rewards (Q. Wang et al., 2020). Moreover, in collectivist culture, rather than focusing on individual benefits, exchanges are evaluated based on their impact on the collective, meaning employees may sacrifice personal rewards for the well-being of the group or organization (van Knippenberg et al., 2015).

2.2. The direct impact of sustainable leadership on employees' green innovative behaviour

As mentioned in the introduction, sustainable leaders strive to accomplish a balance between economic, social and environmental performance of their company, and also promote systematic innovation (Avery & Bergsteiner, 2011). In order to "encourage systemic inventions with the intention of increasing customer value (…) and provide high-level products, services and resolutions" (Haroon et al., 2019) (p. 2), they use far-reaching vision when decisions are made, reduce turnover and absenteeism,

and build a competent and participative staff. Moreover, when characterising SL, one should take into account the features of such leadership styles as transformational, ethical, servant, spiritual and participative (shared). SL derives inspiration from these leadership styles, however it is the only one that focuses on organizational sustainability and the needs of all company stakeholders (Iqbal & Piwowar-Sulej, 2023a). Therefore, when justifying how SL may impact EIB, one should also consider to certain extent previous research related to overlapping leadership styles.

Leaders influence organizational norms of behaviours as indicated by researchers who examined the issue of how organizational culture is developed (e.g. Schein, 1992). Taking into account the above assumptions of SLT and the highly hierarchical nature of Malaysian culture, it can be stated that employees learn behaviour mainly from their leaders/superiors (Daniels & Greguras, 2014). Nevertheless, popular leaders are more likely to be followed by others, as was demonstrated by Schaubroeck et al. (2012). The cited authors, based on the SLT perspective, suggested that ethical leadership is a good role model to be followed. Ethical leaders are seen by employees to make choices in line with organization's ethical values, regardless of the difficulty of the situation (Svensson & Wood, 2007). Sustainable leaders also act in an ethical way (Svensson & Wood, 2007), which enhances their ability to encourage desired employee behaviour.

Moreover, SLT argues that not always learning only through observation will be effective. In complex innovative processes, employees will learn more from leaders who guide and support people such as is the case of transformational leaders (Mehmood et al., 2022). Sustainable leaders also foster the growth of employees' capabilities, cultivate a culture of collaboration and ethical practices, and encourage employees to engage in knowledge-sharing, exploration, and experimentation (Doh & Quigley, 2014; Ferdig, 2007; Gerard et al., 2017). In this way they guide their followers to identifying and exploiting green opportunities, and thus encourage them to engage in eco-friendly innovative activities.

Finally, research conducted in Malaysian universities revealed that not only top management support, but also employee empowerment, were crucial in stimulating green behaviour in the workplace (Farooq et al., 2023). Sustainable leaders share power, grant autonomy to employees and lead by example just like participative leaders (Nazir & Shah, 2014), which enhances their ability to encourage EIBs. Based on the above, the following hypothesis was formulated:

H1: SL significantly and positively influences EIB.

2.3. The mediating role of green knowledge sharing in the "sustainable leadership-employees' eco-friendly innovative behaviour" relationship

Employees' green behaviour also includes, besides EIBs, recycling and reusing, conservation of energy, picking up litter on the premises, reporting environmental problems, collecting and sharing green knowledge and questioning the company's potentially harmful practices (Graves et al., 2013b; Zoogah, 2018). An important antecedent of green behaviour at individual level – especially in terms of EIBs – is environmental knowledge (Ahmed et al., 2020). This knowledge should be shared since this helps people not only learn from others, but also produce creative and valuable ideas (Mehmood et al., 2021) and develop individual cognitive capacities (Carmeli et al., 2013).

GKS can be defined as behaviour related to "sharing with other employees the information and knowledge about green issues, promoting learning opportunities, encouraging others to learn and create new knowledge for each other" (Chang & Hung, 2021, p. 6). In particular, sharing tacit knowledge enhances organizational learning and problem-solving capabilities, and fosters innovative behaviour (Z. Wang, Ren, Chadee, Liu, et al., 2021). W. Zhang et al. (2021) found that GKS impacts employees' green behaviour, however they did not examine innovative behaviour, whilst Chang and Hung (2021) provided evidence that GKS is positively related to green creativity, yet they did not examine holistically-viewed innovative behaviour which means more than mere creativity.

In collectivist cultures, knowledge sharing is deeply influenced by group orientation, social norms, and interpersonal relationships. Individuals prioritise the well-being of the group over personal gain, which fosters a stronger inclination to share knowledge for the collective success. However, previous research showed that collectivism alone is not enough to stimulate knowledge sharing among employees. Incentives play a crucial role in knowledge sharing, even in collectivist cultures. Both intrinsically and extrinsically motivated individuals are more likely to share knowledge, while a trusting environment further enhances knowledge sharing (Ma et al., 2014). Other research provided evidence that leadership is a significant factor influencing knowledge sharing because leaders inspire trust in teams, collaboration and communication (Tripathi et al., 2021). Based on SET, it can be argued that leaders are able to support positive resource exchanges, such as knowledge sharing. The literature highlights that decentralised, empowering and servant leadership styles are well-suited to provide employees with positive resources, e.g. knowledge sharing, due to their close proximity to people (Bou Reslan et al., 2021; Srivastava et al., 2006; Xue et al., 2011). Sustainable leaders prioritise knowledge sharing, shape opportunities for exploration and empower individuals (Iqbal & Piwowar-Sulej, 2023b). In the high-power distance and collectivist Malaysian (Koay & Lim, 2022) and Chinese (Xia & Yang, 2020) cultures, ethical leadership was found to be an effective means of stimulating knowledge sharing. Thus, sustainable leaders can enhance knowledge sharing through being ethical and developing prosocial motivation, aligning the needs of different company stakeholders (Pian et al., 2019), in accordance with collectivist cultural orientation. Furthermore, psychological safety plays a role in influencing knowledge sharing (Mehmood et al., 2022) and sustainable leaders foster a psychological safe working environment (Iqbal et al., 2020). One more assumption based on SET is that when employees become aware of the benefits of adopting green practices through GKS (e.g. promotion opportunities given by sustainable leaders), they are more inclined to reciprocate with voluntary eco-friendly modes of behaviour such as EIB (Darvishmotevali & Altinay, 2022). However, as indicated before, social exchanges in Malaysian culture can be more hierarchical, group-oriented, and shaped by the good of the community rather than personal benefit.

As shown above, employees' EIBs are products of exchange for GKS promoted by a leader, therefore it is expected that GKS will mediate the relationship between SL and EIBs, as presented in the following hypothesis:

H2: GKS positively mediates between SL and EIB.

2.4. Moderating impact of green awareness on the "sustainable leadership-green knowledge sharing" relationship

GA is a multidimensional concept, defined as beliefs about the environment and an inner deep understanding of the relationship between human beings and the surrounding nature (Płatkowska-Prokopczyk, 2017). GA also refers to one's values towards environmental issues, and can be divided into environmental risk awareness and environmental benefit awareness (Rui & Lu, 2021). In the case of leaders, the first type of GA refers to the negative environmental impacts of organizational behaviour. Recognising the negative impact of non-sustainable practices on the natural environment motivates individuals to adopt green practices to contribute to environmental conservation (Ojo & Fauzi, 2020). In turn, environmental benefit awareness is connected with leaders' awareness of the benefits that result from achieving environmental goals, such as a positive image of the company, and an increase in profits (Rui & Lu, 2021).

GA is developed through the observation and analysis of phenomena, events and activities performed by governments, organizations (e.g. awareness training (Law et al., 2017)) and individuals (Płatkowska-Prokopczyk, 2017). Formal education also plays an important role in shaping GA, as it has been acknowledged that the field of study is one of the educational factors differentiating the level of GA among individuals (Bernaciak et al., 2021).

GA influences an individual's knowledge, tendency, intentions, attitudes, attempts, behaviour and actions (Wan et al., 2017). It has the potential to change individual perceptions and emotional responses towards sustainability (Ojo & Fauzi, 2020). Other authors provided evidence for the link between employees' individual GA and their pro-environmental behaviour (Handayani et al., 2021), including innovative one (Piwowar-Sulej et al., 2025), however this may refer not just to line employees but also to leaders, including sustainable leaders. The more environmentally conscious leaders are, the more they can realise opportunities and potential benefits of eco-friendly innovation. Leaders with high GA should be more likely to adopt proactive green strategies, implement green innovation as well as identify and utilise the potential of their teams (Burki & Dahlstrom, 2017). Hence GA of a leader may encourage employees' environmental curiosity and thus contribute to GKS.

Although sustainable leaders should undertake mindful actions to effect positive organizational, environmental, economic and social changes, they may have different experiences, educational backgrounds, system perceptions and judgments (Mumford et al., 2017), all of which result in the level of GA. When sustainable leaders have a better understanding of the significance of the natural environment and of their own crucial role in protecting the environment, they should be more effective in promoting GKS. Therefore, GA should positively moderate the SL-GKS relationship, as highlighted in the following hypothesis:

H3: A leader's GA positively moderates the relationship between SL and GKS.

The above theoretical relationships between variables are illustrated in Figure 1.

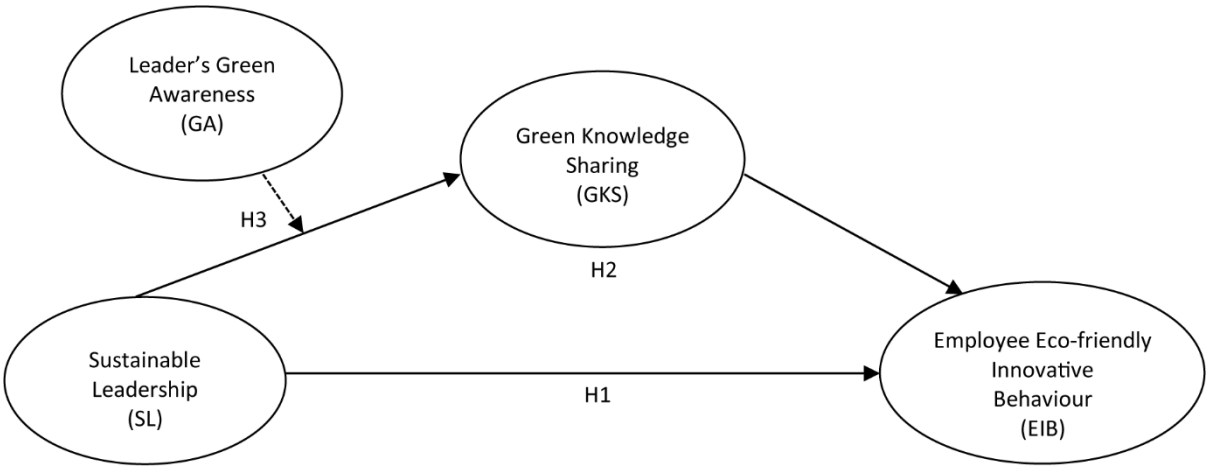

Fig. 1. Research framework.

Source: own work.

3. Methods

3.1. Participants and procedure

Manufacturing SMEs in Malaysia are categorised based on their number of employees and annual sales revenue. Most SMEs in Malaysia, i.e. 61%, operate in five states, namely Selangor (19.8%), Kuala Lumpur (14.7%), Johor Bharu (10.8%), Perak (8.3%), and Penang (7.4%) (Department of Statistics, 2016). Therefore, considering the time and financial constraints and obtaining support from researchers in local universities, the cluster-sampling method was used to collect data from employees of manufacturing SMEs in those five states. Moreover, in order to ensure the collection of sufficient data, the authors used the G*Power app which calculates the minimum number of responses required for a given study (Faul et al., 2009). To employ the G*Power app, the study employed F-test along with a priori power analysis, three predictors, statistical power (0.80), significance level (0.05) and effect

size (0.15) (Faul et al., 2009). In this case, 77 was the minimum sample size required to deliver valid and reliable empirical evidence.

The respondents' participation was on a voluntary basis and only for used for the purposes of this research. Since extant literature concluded with 35.70% as the average response rate in social science studies, with ±18.80 standard deviation (Baruch & Holtom, 2008), this survey link was disseminated to 500 manufacturing SMEs' employees working in the five states. When collecting data the authors received assistance from their friends and colleagues who live locally. In total they received 287 completed survey forms. To allow for the missing values, it was mandated to mark against each item in an online questionnaire. The authors also eliminated 4 invalid responses, leaving 283 valid questionnaires for further analysis. As a result, the response rate was 56.60%, which is higher than the above-mentioned average achieved in previous studies.

3.2. Measures

The authors adopted measurement methods from past studies. Since a reduced quality and processing burden in relation to higher Likert scales were reported in previous studies (Robinson, 2018), this study employed 5-point Likert scale ranging from 1 "strongly disagree" to 5 "strongly agree". To examine SL practices, 15-items scales of McCann and Holt (2010) were used. In the Pakistani SMEs context, this 15-item scale was found to be reliable (Cronbach's alpha = 0.668) (Iqbal & Piwowar-Sulej, 2023a), whereas the 4-item scale of GA was adopted from the study of Ryan and Spash (2008) – previously, Han and Yoon (2015) also used this scale and found it highly reliable (CR = 0.925). In this study four measurement items of employees' EIBs were adopted from Zhou and George (2001); Z. Wang, Ren, Chadee, and Sun (2021) also used these items and found them reliable (CR = 0.88). Finally, GKS was measured by five items following Connelly et al. (2012), also used by W. Zhang et al. (2021), who confirmed its high reliability (Cronbach's alpha = 0.887).

The extant literature has claimed the substantial effect of gender, age, qualification and professional experience on employee behaviour (Graves et al., 2013a), therefore the authors treated these categorical variables as control variables. Gender was categorised as 1 for male and 2 for female, whilst age, in years as 1 for <25, 2 for 25-34, 3 for 35-44, 4 for 45-54, and 5 for ≥55. Education was categorised as 1 for PhD, 2 for Master's degree, 3 for Bachelor's, and 4 for diploma. Professional experience, in years, was categorised as 1 for ≤5 years, 2 for 6-10 years, 3 for 11-15 years, 4 for 16-20 years, and 5 for >20 years.

3.3. Analytical strategy

The presence of predictor (SL), conditional factor (GA), intervening variable (GKS) and outcome (EIB) made up the complex research framework in this study, which is also of a prediction-oriented nature. Following earlier recommendations (see Ringle et al., 2020), the authors employed the partial least squares-structural equation modelling (PLS-SEM) analysis, which evolves around the evaluation of both the measurement model and the structural model in the research framework. However, it is mandatory to conduct measurement model analyses prior to the analyses of the structural model. In order to run the PLS-SEM analysis, the authors employed 5,000 resamples and the two-tailed test to examine the 5% significance level, and also adopted Cohen's (1988) criterion to interpret the effect size (f^2) values. According to Cohen (1988), there is small, medium and large impact of predictor on the outcome, provided the f^2 value is greater than 0.02, 0.15 or 0.35, respectively. To examine the model fit, the authors adopted the two index combination strategy (comparative fit index (CFI) ≥ 0.96 and standardised root mean square residual (SRMR) ≤ 0.09) from Hu and Bentler (1999).

4. Results

4.1. Frequency analysis

Females (n=171, 60.42%) dominated in the study sample, with 38.16% of the participants in the age group of 25-34 years, followed by 37 aged between 35-44 years, whilst only 11 participants were over 55 years old. More than 50% of the participants (n=152) held Bachelor's degrees, followed by Master's degree (n=68, 24.03%), and 16 PhD holders (5.73%) also completed the survey. Majority of the participants (n= 97, 34.27%) had 6-10 years of work experience, and fewest participants (n=16, 5.65%) had longer job seniority than 20 years. Regarding business location, most respondents (n=108, 38.16%) worked for SMEs in Kuala Lumpur, followed by (n=79, 27.91%) from Selangor, hence it is evident that more than 60% came from Kuala Lumpur and Selangor. The least number of the participants (n=45, 15.90%) worked for SMEs in Perak state, and only 27 and 24 participants came from Johor Bahru (9.54%) and Penang state (8.48%), respectively. All the demographic information is also presented in Table 1.

Table 1. Demographic analysis

Construct		Frequency	Percent	Cumulative Percent
Gender	Male	112	39.57	39.57
	Female	171	60.42	100.00
Age	<25	70	24.73	24.73
	25-34	108	38.16	62.89
	35-44	37	13.07	75.96
	45-54	57	20.16	96.12
	≥55	11	3.88	100.00
Education	PhD	16	5.65	5.65
	Master	68	24.03	29.68
	Bachelor	152	53.71	83.39
	Diploma	47	16.61	100.00
Experience	≤5 years	31	10.95	10.95
	6-10 years	97	34.27	45.22
	11-15 years	84	29.68	74.90
	16-20 years	55	19.45	94.35
	>20 years	16	5.65	100.00
Location	Kuala Lumpur	108	38.16	38.16
	Selangor	79	27.91	66.07
	Penang	24	8.48	74.55
	Perak	45	15.90	90.45
	Johar Bahru	27	9.55	100.00

Source: own work.

4.2. Descriptive analysis

The participants rated SL, GA, GKS and EIB on the 5-point Likert scale. Their mean values ≤2.99, in the range of 3 to 3.99 and ≥4.00, exhibit their low, moderate and high presence, respectively (Sekaran & Bougie, 2016). In this study, the mean values of SL (3.189), GKS (3.008), EIB (3.143) and GA (3.050) were in the range of 3 and 3.99 (see Table 2), which is a clear indicator of their moderate presence in manufacturing SMEs in Malaysia.

4.3. Data screening

The authors investigated the presence of missing values, outliers, common method bias and data normality. The marking of mandatory checks against each item in the online survey form ensured the data was free of any missing values. The study also calculated Z-score to identify univariate outliers in the dataset. Six cases related to the SL were classified as univariate outliers because of their Z-score greater than 2.68. Moreover, to assess multivariate outliers, the authors ran the Mahalanobis distance test. As a result, 11 cases were deleted as multivariate outliers because of their probability of the Mahalanobis distance test values below 0.001. Both the univariate and multivariate outliers were removed from the dataset. The Web Power statistical power analysis online tool was used to investigate the univariate normality and multivariate normality in the data. Skewness values of SL (0.258), GKS (-0.088), GA (-0.161) and employee's EIB (-0.221) were below ±3 (see Table 2), whilst their kurtosis values were also within the range of +3 and -3, which clearly indicated the univariate normality of the data (DeCarlo, 1997). However, Mardia's skewness value ($\beta = 0.712, \rho < 0.005$) was found significant but its kurtosis value ($\beta = 24.547, \rho = 0.437 > 0.005$) was non-significant, which means that the current dataset did not possess multivariate normality.

The Harman's one-factor test, as a statistical tool, was carried out in the study, which concluded that the dataset was free of any common method bias as the first factor only counted 22.799% of total variations. Since Harman's one-factor test has received a lot of criticism from researchers because of its insensitivity, a correlation matrix procedure was also included to assess any common method bias. According to Bagozzi et al. (1991), common method bias emerges as a problem in case of correlation among latent variables greater than 0.90, whereas in this study the highest correlation was 0.821, thus making it freer of common method variance. Furthermore, the authors also examined the model fit by employing the two-index combination strategy of Hu and Bentler (1999), demonstrating that there is a model fit if its comparative fit index (CFI) ≥ 0.96 and standardised root mean square residual (SRMR) ≤0.09. In this study, the four-factor model comprising SL, GKS, GA and employee's EIB, was proved fit because $CFI = 0.966 > 0.96$ and $SRMR = -.056 < 0.09$.

4.4. Measurement model results

The authors checked the reliability and validity of SL, GKS, employees' EIB and GA through the assessment of the measurement model, and the indicators loadings were found in the range of 0.564 and 0.873, higher than 0.50 (see Table 2), which was a sign of indicators' reliability (Chin, 1998). One item of SL was removed from the measurement model because of its loading below 0.40 (Hair et al., 2017). Composite reliability (CR) values were also checked to decide about the internal reliability of reflective constructs, where a reflective construct has acceptable internal reliability provided its value ≥ 0.70 (Hair et al., 2017). Composite reliability (CR) values of SL (0.936), GKS (0.847), EIB (0.859), and GA (0.831) were above 0.70 (see Table 2), which indicated acceptable internal reliability.

According to Hair et al. (2020), acceptable convergent validity of a construct requires its indicators' loadings >0.70 and the average variance extracted (AVE)>0.50. Loadings above 0.40 are also acceptable, provided AVE is greater than 0.50. In this case, except for one item of SL, all the measurement items had their loadings above 0.50. AVE values of SL (0.515), GKS (0.531), EIB (0.607) and GA (0.553) were found to be greater than 0.50 (Table 2), thus all of them possessed acceptable convergent validity. In this study, the Fornell-Larcker criterion (Fornell & Larcker, 1981) was employed to examine the discriminant validity of the continuous variables. The measurement model analysis demonstrated that inter-construct correlation values of SL, GA, GKS and EIB were lower than the square root of their respective AVE values, which was a clear sign of their acceptable discriminant validity.

Table 2. Factor loadings, reliability and average variance extracted (AVE)

Construct	Item	Loading	CR	AVE
GA (M=3.050, skewness = -0.161, kurtosis= - 0.224)	Leaders in your firm believe that the effects of pollution on public health are worse than we realise.	0.750	0.831	0.553
	Leaders in your firm believe that thousands of species will become extinct over the next several decades.	0.701		
	Leaders in your firm believe that there is an increasing negative impact of pollution on the Earth's changing climate.	0.666		
	Leaders in your firm believe that environmental protection provides a better world for us and our children.	0.845		
GKS (M=3.008, skewness= -0.088, kurtosis= 0.179)	Employees in your firm look into your environmental requests to make sure their answers are accurate.	0.564	0.847	0.531
	Employees in your firm explain everything about the environment very thoroughly.	0.713		
	Employees in your firm answer all your environmental questions immediately.	0.834		
	Employees in your firm tell you exactly what you need to know about the environment.	0.806		
	Employees in your firm go out of their way to ensure that they understand your environmental requests before responding.	0.694		
EIB (M=3.143, skewness= -0.221, kurtosis = 0.190)	Employees in your firm have new and innovative ideas.	0.873	0.859	0.607
	Employees in your firm come up with creative solutions to environmental problems.	0.843		
	Employees in your firm often have a fresh approach to environmental problems.	0.663		
	Employees in your firm suggest new ways of performing environment-related work tasks.	0.718		
SL (M = 3.189, skewness= 0.258, kurtosis = 0.232)	Leaders in your firm act in a sustainable socially responsible manner.	0.682	0.936	0.515
	Leaders in your firm act in a sustainable environmentally responsible manner.	0.845		
	Leaders in your firm act in a sustainable ethically responsible manner.	0.673		
	Leaders in your firm make decisions while considering the entire organization.	0.701		
	Leaders in your firm officially recognise when a mistake is made that it affects sustainability.	0.706		
	Leaders in your firm correct mistakes that affect sustainability.	0.578		
	Leaders in your firm use unique innovative methods to resolve sustainability issues.	0.745		
	Leaders in your firm create wealth through sustainable efforts.	0.690		
	Leaders in your firm put purpose before profit.	0.687		
	Leaders in your firm balance sustainable social responsibility with profit.	0.779		
	Leaders in your firm demonstrate sustainability by persevering through all types of change.	0.676		
	Leaders in your firm are concerned about how sustainability affects employees.	0.767		
	Leaders in your firm communicate sustainability decisions to all involved.	0.801		
	Leaders in your firm attempt to build a culture of sustainability through their communication efforts.	0.674		

Source: own study.

4.5. Hypotheses testing

Prior to analysing the path model, the authors examined the collinearity. Variance inflation factor (VIF) of SL (3.026), GKS (1.343), and GA (4.026) were found lower than cut-off value i.e. 5 (Hair et al., 2021), hence collinearity was not an issue in the current setting. In addition, R square values demonstrated a weak and moderate explanatory power of GKS (0.377) and EIB (0.515), respectively. Furthermore, a blindfolding procedure was ran to assess the path model's predictive accuracy, and the results showed a low and medium predictive relevance of GKS (Q^2=0.240>0.25) and EIB (Q^2=0.288>0.25). The effect size (f^2) assessment demonstrated the medium and large effects of SL (0.121) and GKS (0.361) on the employees' EIB (Cohen, 1992).

Prior to path model analysis, the authors also examined the control variables association with the employees' EIB. The findings did not support any association of the control variables, namely gender ($\beta = 0.045, \rho > 0.05$), age ($\beta = 0.049, \rho > 0.05$) education ($\beta = 0.049, \rho > 0.05$) and professional experience ($\beta = 0.049, \rho > 0.05$) with the employees' EIB. Next, SL, GKS and GA were introduced into the main model. The assessment of structural model revealed that sustainable leaders did not significantly influence employees' green innovative behaviour ($\beta = 0.049, \rho > 0.05$), therefore the

direct impact of SL on employees' EIB was rejected, hence Hypothesis H1 was not supported. The path coefficient (β) indicated a very weak direct relationship of SL with EIB. In the real-world scenario, even if a leader promotes sustainability, it may not effectively foster environmentally friendly behaviour unless other factors work for it.

The indirect effect of SL on employee's EIB, which is a product of the coefficient value of the SL-GKS relationship ($\beta = 0.747$) and GKS-employee's EIB ($\beta = 0.738$), was significantly positive ($\beta = 0.552, \rho < 0.05$) (see Table 3), which means that sustainable leaders indirectly significantly influenced employees' EIB through GKS, hence mediation hypothesis H2 was accepted. As evident from β value, SL has a strong indirect positive impact on EIB through GKS, which demonstrates that the real influence of SL is indirect, working through mechanisms such as communication, collaboration, and a green-supportive climate.

Table 3. Hypotheses testing

Relationship	B	S.D	T-value	P-value	LLCI	ULCI
SL -> EIB	0.049	0.065	0.747	0.456	-0.068	0.188
SL -> GKS -> EIB	0.552	0.046	12.121	0.000	0.465	0.642
SL*GA -> GKS	0.014	0.037	0.378	0.706	-0.057	0.083

Source: own work.

Hypothesis H3 claims that the relationship between SL and GKS strengthens with increasing values of GA. The analysis of the structural model provided evidence about the non-significant effect ($\beta = 0.014, \rho > 0.05$) of the interactive terms of SL and GA on GKS (see Table 3), indicating that GA did not moderate the SL-GKS relationship. Thus, hypothesis H3 was rejected. Here, β value concluded that GA alone is not a strong catalyst for converting leadership intent into knowledge-sharing behaviour.

5. Discussion

The primary goal of this study was to examine employees' EIB as an outcome of SL in manufacturing SMEs in Malaysia. The presented research model also included a mediating mechanism in the form of GKS and was developed based on two theoretical lenses, i.e. SLT and SET. Moreover, GA was used as a conditional variable in the relationship between SL and EIB. This study represents the first empirical investigation into the relationship between the analysed variables.

5.1. Main findings and their theoretical implications

Although literature emphasises that SL encourages innovation in the workplace through equipping employees with necessary resources (e.g. empowerment, competencies, support) and leading by example (Iqbal & Piwowar-Sulej, 2023b), this leadership style is not effective in shaping EIBs in a direct way in the surveyed companies as suggested in hypothesis H1. As stated in the theoretical part of this paper, drawing on SLT, sustainable leaders should be attractive role models to follow by employees, an assumption primarily based on research conducted in Western countries (Mayer et al., 2009; Schaubroeck et al., 2012). As Fikret Pasa (2000) revealed, the "influence tactics'" used in the West are not frequently used in cultures with collectivist characteristics and high power distance. Malaysian culture is collectivistic in its nature and has the highest power distance of any country in the world (100 points on the Hofstede index of comparative power distance), meaning that employees accept a hierarchy in companies. Leaders make ultimate decisions and people are not expected to express their opinions (Hofstede Insights, 2022). In high power distance cultures, e.g. Malaysia, empowering behaviour used by sustainable leaders may conflict with the cultural norm of power distance orientation, which highlights the unequal distribution of power (Kwan et al., 2024), mitigating the impact of leadership on the employee behaviour. However, previous research conducted in Malaysian universities revealed that employee empowerment and top management support were crucial in

stimulating green behaviour in the workplace (Farooq et al., 2023), therefore it can be argued that, beyond national cultural characteristics, the structural specifics of manufacturing SMEs also play a significant role. In this sector, SL – with its emphasis on empowerment – may be perceived as weak and ineffective in directly shaping employee behaviour. Malaysian manufacturing SMEs often operate in cost-sensitive and efficiency-driven environments, where risk-taking is discouraged. This sector is also highly reliant on manual labour (Yan Yi et al., 2021). Employees may hesitate to engage in innovative behaviour if they lack clear directives and strong leader endorsement, which empowering leadership does not always provide. An ideal leadership style in such circumstances is benevolent autocratic, characterised by exercising absolute power over the employees and being simultaneously perceived to do so with regard for the benefit of the staff as a whole (Yao et al., 2021). Exercising this leadership style may increase the perceived homophily between the leader and the follower (Koveshnikov et al., 2022).

The second reason for the lack of direct impact of SL on EIB (rejection of H1) is that a mediating mechanism is needed. For example, Xu et al. (2022) revealed that in Chinese collective and high-power distance culture, environmental leadership needs a mediator in the form of green identity to increase employees' EIB. In the presented research, GKS proved to be an effective mediator between SL and EIB, and thus hypothesis H2 is supported. The need for GKS may be explained not only with the use of the SET, but also – once again – with the focus on the cultural characteristics of the examined country. Malaysia is a collectivistic society, which is manifested in a commitment to groups, including work teams. Employees take responsibility for fellow members of their group and management is based on shaping relationships in the groups. SL is an answer to the question posed by Pellegrini et al. (2020) about effective leadership behaviour to develop knowledge sharing in organizations. Sustainable leaders – through promoting collaboration, open communication and trust in teams – support positive resource exchanges in the form of GKS. As a result, through promoting GKS they impact employees' EIBs. This supports extant literature which stresses that the exchange of tacit knowledge enhances innovative behaviour (e.g. (Z. Wang, Ren, Chadee, Liu, et al., 2021; Ye et al., 2021). For the team to generate creative and valuable ideas, its members must engage in the sharing of their insights and information (Mehmood et al., 2022).

This study also adds to the existing literature as it is the first to introduce and validate the moderating influence of leaders' GA on the SL-GKS relationship revealing that GA did not moderate the relationship between SL and GKS, thus rejecting hypothesis H3. This is in contradiction to previous research, which emphasised that leaders with high GA are more proactive in environmental issues (Burki & Dahlstrom, 2017; Chang, 2011; Egri & Herman, 2000). The study also enriches knowledge about SL showing that the core characteristics of this leadership style, which include "retaining and deepening the knowledge of anything that spreads and lasts without doing any harm, and assuring a positive impact on everything that surrounds us at present and will surround in the future" (Šimanskienė & Župerkienė, 2014)(p. 88), do not require interference into GA to make a leader more pro-active in terms of promoting GKS. Furthermore, in Malaysian SMEs, knowledge-sharing behaviour may be more influenced by cultural and structural elements (e.g. team dynamics, organizational norms) rather than by the leader's personal attributes. Employees may engage in GKS due to peer influence, or expected professional responsibilities rather than the leader's ecological awareness. As demonstrated by Wei et al. (2024), people in Malaysian SMEs enjoy GKS among each other informally. Finally, if employees already possess a high level of environmental awareness, they may engage in green knowledge sharing independently of their leader's awareness.

5.2. Implications for practitioners

According to Singh et al. (2019), Malaysian manufacturing SMEs' sector – although it is in a developing stage and this may lead to negative environmental impacts – should implement green innovation strategies to gain a competitive edge over its rivals. Enhancing green innovation performance allows manufacturing SMEs to improve efficiency and effectiveness while preserving their core strengths.

This study advances understanding of the circumstances in which employee's EIB occurs. As a result, it holds significant implications for managers seeking to encourage employees' EIB – not only in Malaysian manufacturing SMEs. First, this study provided evidence that in the surveyed companies SL does not directly impact employees' EIBs, however sustainable leaders indirectly significantly influence employee's EIB through GKS. Since both EIB and GKS are on a moderate level and, according to Sustainable Development Report 2021, significant challenges related to environmental protection remain for Malaysia (Sachs et al., 2021), there is a need for promoting GKS among Malaysian employees. GKS, as revealed in this study, is an important antecedent of EIB in the manufacturing SMEs' sector context. Managers in manufacturing SMEs are recommended to build trust and open communication in teams to enhance collective understanding of environmental issues and spreading of environmental knowledge. Thanks to these activities they will stimulate employees' EIBs.

Second, this study provides valuable material for educational institutions, including valuable insights for designing leadership training programmes, which are essential in the labour-intensive Malaysian SMEs' sector. The study also highlights the fact that cultural issues are of utmost importance in research in the business management field, and shows that much evidence on shaping employees' innovative behaviour – including EIBs – has been provided by research conducted in Western countries. A leaders' behaviour which is expected in Western cultures, could be totally ineffective in the East. Therefore, issues related to cultural differences should be incorporated into the environmental management curricula since success in shaping a sustainable future will also depend on the sensitivity of leaders to cultural differences in their behaviour.

5.3. Limitations

Despite the valuable contributions made by this study to the existing literature, it does have certain limitations, which also open up opportunities for further research. Primarily, the study was limited to Malaysian manufacturing SMEs. Future research could expand on the topic by collecting data from other sectors, companies of various sizes, and different countries. Second, the study was cross-sectional, therefore future research could adopt a longitudinal design to monitor how the variables evolve over a period of time. Third, the authors posited the direct impact of SL on EIB, however there is a likelihood that EIB may foster SL practices, along with the possibility that missing or omitted variables may influence EIB. Thus endogeneity may appear as a threat to the PLS-SEM results' reliability and validity (Antonakis et al., 2010; Piwowar-Sulej & Iqbal, 2024). Accordingly, future studies are encouraged to conduct a Gaussian Copula test to provide empirical findings with reduced endogeneity bias (Hult et al., 2018). Fourth, this study examined a moderating variable in the form of leaders' GA, providing evidence that GA does not matter in the relationship of SL with GKS. Therefore, it would be worth examining the role of employees' GA in stimulating GKS. Hence, the authors also recommend exploring further sustainable leaders' characteristics in future research projects. Taking into account cultural issues, a leader's social awareness – as the ability to understand and empathise with individuals (Hoover et al., 1983) – could be an interesting variable to examine.

6. Conclusion

Through the survey data from 283 manufacturing Malaysian SMEs and the use of PLS-SEM, this study analysed the effects of SL on employees' EIB as well as the intervening mechanism in the form of GKS. Moreover, GA was examined as a moderator in the SL-GKS relationship. In terms of theoretical significance, the authors not only expanded the limited empirical evidence on the effect of SL on EIBs but also contributed to knowledge through matching two theoretical lenses of SLT and SET.

This study provided evidence – contrary to the authors' expectations – that SL has no significant direct effect on employees' EIB, yet sustainable leaders may influence employees' proactive eco-friendly behaviour through promoting GKS. These findings stress that assumptions made on the basis of

research conducted in the West are not met in such countries as Malaysia. High power distance and collectivism were suggested as crucial factors in explaining the way from SL to employees' EIBs. The study also demonstrated that GA does not have a moderating power in the "SL-GKS" relationship.

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