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A novel approach to green innovative work behavior: green HRM and employee participation

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Abstract

Purpose – Drawing on social exchange theory, this study examines the effect of green human resource management (GHRM) on two types of employee green innovative behavior (in-role and extra-role), with employee participation as a moderator.

Design/methodology/approach – The hypotheses were verified based on data from 397 respondents employed in the production departments of manufacturing companies in Poland. PLS-SEM was applied in the statistical process. Drawing on the "House of participation" model, employee participation was treated as a categorical variable in this study.

Findings – The study demonstrates that GHRM positively influences two types of employee green innovative behavior; however, the impact of GHRM on extra-role behavior is higher than on in-role behavior. Similarly, the conditional impact of employee participation on the "GHRM – extra-role green innovative behavior" relationship is higher than that on the "GHRM – in-role green innovative behavior" relationship.

Practical implications – The results of this study suggest that to foster employee involvement in sustainability efforts, employers should encourage employees to come up with green ideas and initiatives. More independence and autonomy positively interact with GHRM and boost employee enthusiasm to bring new innovative value to the organization.

Originality/value – This study adds to the literature on GHRM by exploring a unique research framework covering two types of employee green innovative behavior and the neglected factor of employee participation (including employee structural empowerment as the highest level of participation). It also offers practical implications.

Keywords Environmental sustainability, In-role behavior, Extra-role behavior, Informative participation, Consultative participation, Cooperative participation, Structural empowerment

Paper type Research article

Introduction

Industrial globalization has become a defining feature of the economy in recent decades, exerting a notable impact on the natural environment. Therefore, there is a growing requirement for businesses to focus on reducing their adverse effects on the natural environment and embedding environmental sustainability in their strategies (Nguyen *et al.*, 2021). At the same time, innovation is necessary for finding practical, effective, and scalable solutions that address environmental challenges. It enables companies to reimagine and reshape processes, products, systems, behaviors, and entire industries in ways that lead to a more sustainable and resilient future (Zhang *et al.*, 2023). The above emphasizes the need for employees to engage in green innovative behavior that includes creating, promoting, and realizing green-related ideas and solutions (Aboramadan, 2022).

As Piwowar-Sulej *et al.* (2023) emphasized, there are many inconsistencies in the literature related to defining and measuring employee green innovative behavior, which is often

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categorized as extra-role behaviors, though some authors include them as part of broader green behaviors. Others do not show if green innovative behavior is in-role or extra-role. Consequently, Piwowar-Sulej *et al*. (2023) called for research focusing on two types of green innovative behavior (in-role and extra-role). Therefore, this study aims to be the first to examine these types of green innovative behavior to fill the above research gap.

Despite the importance of green innovative behaviors in organizational environmental performance, still little is known about what drives these behaviors (Olya *et al.*, 2024; Piwowar-Sulej *et al*., 2023). Green human resource management (GHRM), defined as the integration of environmental considerations into various HR policies and practices – such as job description, performance evaluation, training, rewards and promotion (Piwowar-Sulej *et al.*, 2023) – plays a crucial role in enhancing environmental performance within organizations (Renwick *et al*., 2016). However, most existing studies have primarily focused on examining the relationship between an individual HRM practice and broadly defined employee green behavior (Ababneh, 2021). Furthermore, while the connection between GHRM and green innovative behavior may seem evident, prior research has revealed contradictory results on the impact of GHRM on broadly defined employee green behavior (for more, see: Piwowar-Sulej *et al.*, 2023). Based on social exchange theory (SET) (Blau, 1964), which argues that the interactions between parties generate obligations between them, it can be claimed that if an employer provides employees with high-quality resources (e.g. knowledge, rewards, promotion opportunities) as a part of GHRM, they will be more likely to act innovatively (Piwowar-Sulej *et al.*, 2023). Consequently, this study aims to explore the direct connections between a set of GHRM practices and both employee in-role green innovative behavior and extra-role green innovative behavior.

Furthermore, enhancing environmental outcomes necessitates efforts beyond simply implementing GHRM practices (Ren *et al.*, 2021). Previous researchers have demonstrated that centralization, i.e. the extent to which the power to make decisions is centralized in the organization's upper echelons, influences employees' innovative behaviors (Rhee *et al.*, 2017). The issue of centralization corresponds with employee participation, which refers to the practice of involving employees in decision-making processes, problem-solving, and the overall management of an organization (Kouakou, 2022). The higher the centralization, the lower the participation (Rhee *et al*., 2017). The literature distinguishes different levels of employee participation (Wilkinson *et al.*, 2013). This study follows the "House of participation" concept, which covers four levels: informative, consultative, cooperative participation and employee (structural) empowerment (delegating power and credentials) as the highest form of participation (Cierniak-Emerych and Piwowar-Sulej, 2017).

Most previous studies examined the role of psychological empowerment in stimulating employees' innovative behavior (e.g. Mustafa *et al*., 2022; Quratulain *et al*., 2021), including green innovative behavior (Hameed *et al.*, 2020). Psychological perspectives on empowerment elucidate this idea as a collection of thoughts or psychological states that function as a source of motivation, fulfilling an individual's desire for self-determination and bolstering their beliefs in their own effectiveness (Quratulain *et al*., 2021). Hameed *et al*. (2020) associated psychological empowerment with green empowerment, and listed innovative behaviors among extra-role behaviors. In turn, in their literature review on green employee empowerment, Tariq *et al*. (2016) defined it as a compilation of employee involvement in pursuing green organizational tasks, participation in decision making and psychological empowerment. These inconsistencies in approaching employee empowerment, the lack of studies on different levels of the role of employee participation in enhancing employee innovative behaviors, as well as the scant empirical evidence on conditional factors under which GHRM is effective (Piwowar-Sulej *et al*., 2023), all highlight the need for research on the role of employee participation in stimulating in-role green innovative behavior and extra-role green innovative behavior. Thus, the second aim of this study is to examine the conditional role of employee participation in the relationship between GHRM and both in-role green innovative behavior and extra-role green innovative behavior.

This article contributes to theory in the following ways. Firstly, it responds to the call for more research on the factors stimulating employee green innovative behaviors (Aboramadan, 2022; Piwowar-Sulej *et al.*, 2023). It enriches GHRM literature by developing and empirically investigating a unique research framework that covers the relationships between GHRM treated holistically and employee green innovative behaviors (in-role and extra-role). Secondly, this study also contributes to SET by revealing the usefulness of this theory in explaining both types of employee innovative behavior. Thirdly, it is also the first study to examine the moderating role of employee participation in these relationships. Fourthly, most studies on GHRM in the manufacturing sector have been conducted in China (Austen and Piwowar-Sulej, 2024). In contrast, this study utilizes data from line employees working in Polish manufacturing companies. Therefore, this study fulfills the postulate of Piwowar-Sulej and Kołodziej (2022) for more research on the antecedents to employee green behavior in this developed Central European country, which underperforms in many environmental indicators and ranks 38th among the 132 economies in the Global Innovation Index (2022) ranking. Finally, it also offers many practical implications for transforming the manufacturing sector toward environmental sustainability.

Theoretical background and hypotheses development

Green innovative behavior as a research construct

Green innovative behavior is a type of green (pro-environmental, environmentally-friendly, ecological) behavior that contributes to environmental sustainability (Ones *et al.*, 2015) [1]. Some authors (e.g. Graves *et al.*, 2013; Piwowar-Sulej *et al.*, 2024) treat these behaviors as a unidimensional construct, incorporating items that reflect innovative behaviors alongside various other indicators of green behavior. However, some studies categorize green behaviors into in-role behaviors (formally required and rewarded) and extra-role behaviors (voluntary organizational citizenship behaviors to the benefit of the environment). Green innovative behaviors are typically placed in the latter category of green behaviors (Agrawal and Pradhan, 2023; Alwheshi *et al.*, 2024; Boiral and Paillé, 2012; Jankelová *et al.*, 2024).

Considering the notion of extra-role green behaviors, in general management literature, these are defined as activities other than creating and implementing innovation, such as demonstrating extra effort, supporting co-workers and the organization, and volunteering (Stoner *et al.*, 2011). Therefore, measurement scales used in research on organizational citizenship behavior to the benefit of the environment consist mostly of items that reflect voice or helping behaviors (Boiral and Paillé, 2012; Jankelová *et al.*, 2024). There are also authors (e.g. Lamm *et al.*, 2013; Wang *et al.*, 2023; Ye *et al.*, 2022) who do not list innovative green behavior among these behaviors. Therefore, Aboramadan (2022) introduced green innovative behavior as a third group of green behaviors in the workplace (beyond in-role and extra-role behaviors). However, the items used by this author on the green innovative behavior measurement scale (e.g. "I investigate and secure funds needed to implement new green ideas") do not show if a given behavior is in-role or extra-role. Finally, there are also studies specifically focused on employee green innovative behaviors; however, these adopt different approaches. For instance, Olya *et al.* (2024) associated these behaviors with extra-role activities, while Jiang *et al.* (2025) did not specify whether they are in-role or extra-role.

Defining and measuring employee green innovative behaviors in different ways also hampers the understanding of their antecedents. Dumont *et al.* (2017) only found a link between GHRM and green in-role behaviors. In turn, Saeed *et al.* (2019a, b), Islam *et al.* (2021) and Ababneh (2021) revealed a significant link between GHRM and employee green in-role and extra-role behavior. Fawehinmi *et al.* (2020) identified no significant effect of GHRM on broadly understood employee green behavior. In turn, Liu *et al.* (2024) found support for the impact of GHRM on employee green creativity, which is not as broad as innovative behavior. The authors did not specify whether the creative behavior was in-role or extra-role. Shafaei and Nejati (2023) and Yang and Li (2023) found support for the positive

impact of GHRM on green innovative behavior; however, they did not divide this behavior into in-role and extra-role. Similarly, Aboramadan (2022) and Piwowar-Sulej *et al*. (2023) revealed the positive impact of GHRM on employee green innovative behavior; however, they did not discuss if this behavior was in-role or extra-role. Finally, Yusoff (2019) demonstrated GHRM's direct influence on extra-role green behaviors (organizational citizenship behaviors to the benefit of the environment). However, only one item on the scale used to measure the analyzed behavior partially reflected innovative behavior. Considering the above, this study distinguishes between in-role green innovative behavior and extra-role green innovative behavior, and measures the impact of GHRM on both types of green innovative behavior.

The impact of green HRM on in-role and extra-role green innovative behaviors

Research on general HRM has established that HRM practices contribute to in-role and extra-role behaviors based on SET because they shape employees' perceptions of fairness, support, and reciprocity in the workplace (Korff *et al.*, 2017). Consequently, GHRM leads to favorable outcomes with regard to different types of green behaviors in the workplace (Yusliza *et al.*, 2019). In their literature review on GHRM, Anshima *et al*. (2024) demonstrated that SET (Blau, 1964) is one of the most frequently used theories in this research domain. Drawing on this theory, it can be argued that GHRM fosters a sense of recompense among employees, encouraging them to contribute to the organization's environmental objectives. This is because GHRM encompasses a range of supportive practices that offer employees various resources and opportunities to enhance their skills, knowledge, and attitudes. Based on SET, Piwowar-Sulej *et al*. (2023) and Abdalla (2024) argued that GHRM stimulates both in-role and extra-role green behaviors. Finally, Aboramadan's (2022) study demonstrated that employees tend to reciprocate an organization's pro-environmental stance, in this case, by displaying desired green innovative work behaviors. At this point, it is worth noting that in-role behaviors result from so-called negotiated exchanges for HRM practices (Korff *et al.*, 2017). In such exchanges, partners focus on the tangible benefits they can gain, such as rewards for employees and job performance for employers. Both sides agree on the terms of the exchange before it happens. In turn, in reciprocal exchanges, the expectation of reciprocity is assumed rather than clearly articulated before the exchange takes place. The more employees perceive organizational support and experience trust, the more they develop a global feeling of obligation toward the organization (Molm, 2003).

Green training is crucial in transforming businesses towards environmental sustainability (Piwowar-Sulej, 2021) because it provides employees with the knowledge, skills, and mindset required to develop and implement innovative eco-friendly solutions (Fernandez and Pitts, 2011). Training equips employees with the skills needed for their roles, reducing stress and improving in-role performance (Korff *et al.*, 2017). It can also support idea generation through various techniques, such as design thinking (Talib *et al.*, 2023). It reflects company investment in employees and thus has the potential to generate extra effort in the form of employee extra-role green innovative behavior.

Establishing green responsibilities within job descriptions and setting objectives related to generating and implementing green ideas form the foundation for evaluating innovative activities within the HR appraisal system. This approach is expected to influence employees' in-role green innovative behavior positively. However, during the appraisal process, employees receive constructive and supportive feedback designed to build trust and prompt the desired behaviors (Chiappetta Jabbour *et al.*, 2019), which can give rise to extra-role green innovative behavior.

Furthermore, promotions and rewards based on green criteria are designed to incentivize employees to engage in green initiatives and successfully achieve sustainability-related targets (Ababneh, 2021). It is also worth mentioning that the implementation of GHRM practices can even expand career advancement opportunities within a company that offers green jobs (Piwowar-Sulej, 2022). When employees see the possibility of moving up within the

organization, they feel trusted by their employer and become motivated to go above and beyond their regular duties, engaging in extra-role behaviors.

To sum up, it can be inferred that a company that conveys a consistent message of its environmental commitment and implements GHRM practices can anticipate employees engaging in positive social exchanges (Aboramadan, 2022) by displaying both types of innovative green behavior. This leads to the following hypotheses:

H1a. Green HRM (GHRM) positively relates to employee in-role green innovative behavior.

H1b. Green HRM (GHRM) positively relates to employee extra-role green innovative behavior.

The moderating impact of employee participation

The first level in the "House of participation" concept is associated with informative participation (Cierniak-Emerych and Piwowar-Sulej, 2017). In the context of environmental issues, it demonstrates how the management shares information with employees about matters closely associated with their work, such as green audit reports. It is worth mentioning that in this context, employees can be informed both directly and indirectly, they do not possess the authority to thoroughly examine the information provided, and the management retains the exclusive right to make decisions regarding worker-related matters.

In the second level of participation – employees experience consultative participation (Cierniak-Emerych and Piwowar-Sulej, 2017). In this form of involvement, they are engaged in discussions regarding green issues that pertain to them. However, they are still limited in expressing their opinions openly. The decision to adopt or reject these opinions ultimately lies with the management (Gómez-Ruiz and Rodríguez-Rivero, 2018).

The third level of participation (cooperation in decision-making) covers decisions that are taken together by the management and the employees, which means that the employees' opinions matter (Casey and Delaney, 2022). Cooperative participation can take the form of voting or employees' right to object or acquiesce to certain decisions (Cierniak-Emerych and Piwowar-Sulej, 2017). It emphasizes the value of collaborative decision-making in organizations (Gallie, 2013).

Finally, the fourth level is employee empowerment, i.e. a multidimensional process involving the delegation of decision-making authority to employees. As Bluedorn and Kanter (1978) argued, empowerment arises from decentralization, a flattening of hierarchical structures, and increased employee participation. Kanter believed that access to empowerment mechanisms correlates with an individual's formal and informal power within the organization. Formal power stems from positions considered significant and central to the organization, and roles that offer flexibility, visibility, and opportunities for creativity. In turn, informal power evolves from relationships and networks with colleagues, subordinates, and superiors. This entails delegating authority in particular areas where specific green issues emerge within the operational context of a given business, as people who are close to the problem have the potential to generate more appropriate solutions (Drucker, 1992).

Past research has shown that organizational communication facilitates social exchanges and trust between the parties (employer, employee) involved in the relationship (Curado *et al.*, 2022). Downward communication – associated with employee passive participation – increases job satisfaction, job performance and organizational commitment (Goris *et al.*, 2000; Turulja and Kožo, 2023). Passive participation reflects caring employer behavior by offering employees opportunities to contribute and feel valued without the pressure of active engagement or direct decision-making. However, higher levels of employee participation further exemplify caring employer behavior by actively demonstrating that the organization values and respects its employees' opinions and contributions.

As Rhee *et al*. (2017) stated, higher centralization contributes to employees' feelings of powerlessness, which mitigates their self-efficacy. It reduces employees' intrinsic motivation

and evokes a negative reciprocation, making them less likely to go the "extra mile". In turn, past research has demonstrated that decentralization stimulates innovation (Rangus and Slavec, 2017). As far as lower levels of employee participation are concerned, the implementation of informative participation and consultation for employees at lower levels provides employees with numerous resources. It enhances the circulation of information and knowledge within the organization, fostering a feeling of significance and direction among the workforce (Cox *et al.*, 2006; Wilkinson *et al.*, 2013). Interorganizational transfers of environmental knowledge further stimulate idea generation (Abualoush *et al.*, 2022). Employee participation facilitates open communication channels between management and employees. Khalid and Nawab (2018) found that consultation improves employee engagement and retention, whereas Gupta and Agrawal (2024) provided evidence for its positive impact on idea generation and a reduction of conflicts. However, when green problems and initiatives are communicated effectively and employees are involved in decision-making, there is a better understanding of the environmental goals and the importance of green innovative behaviors.

When employees are given the opportunity to participate in the formulation of green initiatives and strategies, they develop a sense of ownership and commitment (Ben-Ner and Jones, 1995). According to the assumption of SET (Blau, 1964), this sense of ownership can drive them to actively engage in innovative behaviors that align with the organization's environmental objectives. When participation is promoted, employees from various backgrounds contribute diverse perspectives and ideas, leading to more innovative approaches to environmental challenges. Past literature shows that when employees are actively involved in decision-making, strategies are more likely to resonate with their beliefs, motivating them to adopt innovative behaviors (Naqshbandi *et al.*, 2019; Tariq *et al.*, 2016).

As far as structural empowerment is concerned, Bowen and Lawler (1992) revealed two types of innovative behavior among empowered line employees. The first type involved promptly adapting services to meet specific customer needs. The second went beyond immediate fixes, encompassing proactive redesign of processes and systems, as well as the creation of new products and services. These behaviors can be related to the environmental context. As Saeed *et al.* (2019a, b) revealed, employee structural empowerment positively impacts employee green behavior (a unidimensional construct covering innovative behavior).

Considering the above, it can be stated that employee participation can amplify the impact of GHRM initiatives by fostering a culture of involvement, ownership, and commitment among employees (Ali Salahat, 2021), leading to more innovative approaches that contribute to environmental sustainability. Participation also creates a feedback loop where employees can provide insights into the effectiveness of GHRM practices. This feedback helps refine strategies and encourages continuous improvement, fostering a culture of innovation. However, as previous research has found that structural empowerment is the most effective form of direct participation (followed by consultative participation) in fostering employees' sense of importance, motivation to learn new skills, and willingness to go the "extra mile" (Gallie, 2013), the following hypotheses can be formulated:

H2a. Employee participation positively moderates the relationship between green HRM (GHRM) and in-role green innovative behavior, with structural empowerment demonstrating a stronger moderating effect compared to other types of employee participation.

H2b. Employee participation positively moderates the relationship between green HRM (GHRM) and extra-role green innovative behavior, with structural empowerment exerting a stronger moderating effect compared to other types of employee participation.

All hypotheses are graphically presented in Figure 1.

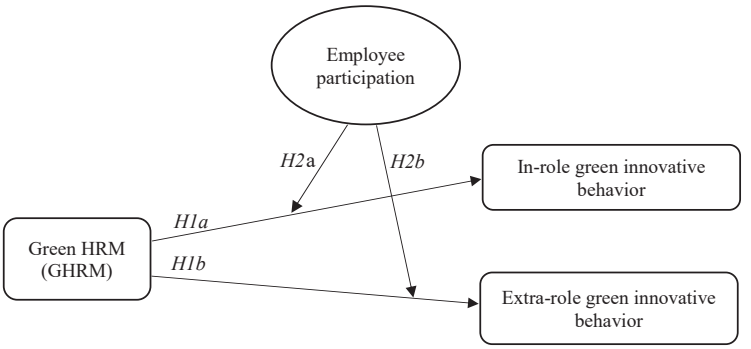

Figure 1. Research model. Source: Authors' own work

Research methodology

Participants and data collection

The authors collected data between January and March 2023 in the form of a survey. The survey was conducted in Polish. The authors translated the English version of the survey form into Polish, validating it through a back-translation process. A language expert compared the Polish and English versions of the survey form and ensured the clarity and accuracy of the language after the double translation procedure. The authors developed an internet-based questionnaire (a Google form) consisting of four parts: personal details and information about the company, GHRM, employee participation, and the outcome variables (in-role green innovative behavior, extra-role green innovative behavior). They distributed it via professional network platforms such as LinkedIn and Goldenline among 670 people working in line positions in the production departments of medium-sized and large manufacturing companies. Participation in the research was voluntary and no sensitive data were collected. Following the steps outlined by Piwowar-Sulej (2022), the authors used a sample size calculator to determine that a minimum of 346 responses was required. This calculation was based on a 95% confidence level, a 5% margin of error, and a 0.5 response distribution, given a population of approximately 3,500 companies. A total of 397 fully completed survey forms were collected, which exceeded the minimum required sample size.

The survey included 244 male participants (61.46%) and 153 female participants (38.54%). 42 (10.58%) had vocational education degrees, 85 (21.41%) had completed secondary school, and 270 (68.01%) had university degrees. Most of the respondents (176, 44.33%) had an employment tenure of more than ten years, followed by those (142, 35.77%) who worked for their current employer for five to ten years. The sample consisted of 176 Gen Y representatives (44.33%, born 1980–1995), followed by 126 Gen X representatives (31.74%, born 1965–1979), 53 Gen Z representatives (13.35%, born 1996 and later), and 42 Baby Boomers (10.58%, born 1946–1964). Most of the respondents (209, 52.65%) worked for foreign-owned and mid-size companies (247, 62.21%).

Measures

GHRM was measured with the use of the five-item scale presented by Piwowar-Sulej *et al.* (2023), who adopted the scale by Dumont *et al.* (2017). The five items covered HRM practices related to job description, HR performance appraisal, HR training, remuneration, and promotion.

In-role green innovative behavior and extra-role green innovative behavior were measured with the use of five-item scales developed with the support of external experts in HRM research and scale development. Both scales include exactly the same five statements, differing only in the context of application (within formal job duties vs outside of them)

(see: Appendix). The scales were based on a six-item scale for measuring general innovative behavior presented by Aboramadan (2022). After conducting content and face validation, one item related to self-perceived innovativeness (i.e. "I am environmentally innovative") was removed from Aboramadan's (2022) scale. Firstly, semantic analysis (Venkatraman and Grant, 1986) revealed a possible misunderstanding of this item because it overlapped with other items. Secondly, the authors aimed at the exploration of innovative behaviors and not the level of self-perceived innovativeness, and followed a parsimony rule, thus using a minimum number of items required to obtain a reliable measurement (Diamantopoulos and Siguaw, 2006). Following Hair's *et al*. (2020) recommendations, in the case of item adaption, the authors also conducted confirmatory factor analysis (CFA) to confirm the scales' distinctiveness.

Due to the study being carried out in the Polish language, certain elements were slightly adjusted to enhance their accuracy (following suggestions obtained from a preliminary study involving 16 participants). All continuous variables (GHRM, in-role green innovative behavior, extra-role green innovative behavior) were assessed using a five-point Likert scale, with 1 representing "strongly disagree" and 5 representing "strongly agree."

Employee participation was measured based on the "House of participation" concept which distinguishes four levels of participation. The authors assigned numbers to the individual levels. Informative participation was coded as 1 (statement: I am informed about green issues that refer to my work), consultative participation as 2 (statement: I am involved as a consultant in discussions about green issues), cooperative participation as 3 (statement: I actively cooperate with managers in decision making related to green initiatives), and structural empowerment as 4 (statement: I have the possibility to decide about green issues autonomously). The respondents selected one – i.e. the prevailing – type of employee participation. Hence, this study treated employee participation as a categorical variable.

Past studies concluded that a company's size, the origin of a company's capital and the respondent's age might affect innovation activities and employee innovative behavior, respectively (Jakimowicz and Rzeczkowski, 2019; Piwowar-Sulej *et al.*, 2023). Additionally, gender can influence levels of employee participation because of existing gender inequalities (Plückelmann *et al.*, 2024). Therefore, the authors considered these factors as control variables in the study. Company size was coded as 1 for medium-sized companies (between 50 and 249 employees) and as 2 for large companies (250 employees and above). The origin of capital was classified as 1 for domestic and 2 for foreign. The age of the participants was classified as follows: 1 for individuals belonging to the Baby Boomers Generation, 2 for Gen X, 3 for Gen Y, and 4 for Gen Z. Gender was coded as 1 for male and 2 for female.

Analytical approach. The research adopts an explanatory approach by focusing on changes in extra-role green innovative behavior and in-role green innovative behavior as influenced by GHRM and employee participation. Consequently, a prediction-oriented approach was deemed appropriate to examine the proposed hypotheses. In line with this, variance-based structural equation modeling (SEM), commonly referred to as partial least squares structural equation modeling (PLS-SEM), was selected as it is more suitable and provides more robust and reliable results compared to covariance-based structural equation modeling (CB-SEM) (Hair *et al.*, 2020). Furthermore, PLS-SEM does not require a large sample size or a normal distribution (Sarstedt *et al.*, 2022).

Preliminary analyses

Data screening

The data screening process focused on the identification of missing values, outliers, data normality, and common method bias. As data were collected through an online survey link, where it was mandatory to check against each item, there were no missing values in the dataset. The Z-score analysis confirmed the absence of univariate outliers as no case was found with a Z-value greater than 3.29. Nevertheless, the Mahalanobis distance test revealed one case as a

multivariate outlier, which was removed prior to further analysis. Regarding data normality, the skewness values were respectively GHRM (0.463), employee participation (−0.648), extra-role green innovative behavior (0.352) and in-role green innovative behavior (−0.355). The kurtosis values of these constructs were also found to be in the range of ±3. This indicates that the dataset has univariate normality (DeCarlo, 1997). In addition, the Mardia's kurtosis ($\beta = 27.151, \rho < 0.05$) and skewness values ($\beta = 1.752, \rho < 0.05$) were also concluded to have multivariate normality (Mardia, 1970).

To statistically check for common method bias, the authors conducted Harman's one-factor test and a correlation matrix procedure. The Harman one-factor test disclosed that first-factor variance only accounts for 22.397% < 50% of total variations. After removal of the second lowest correlation value, there were no significant changes in the correlation values. Therefore, both Harman's single factor test and the correlation matrix procedure showed that common method bias was not an issue. Moreover, confirmatory factor analysis (CFA) demonstrated a good fit ($x^2 = 103.415$, CFI = 0.951 > 0.950, TLI = 0.952 > 0.950, SRMR = 0.070 < 0.090, RMSEA = 0.051 < 0.06) for the proposed four-factor baseline model (GHRM, employee participation, extra-role green innovative behavior and in-role green innovative behavior) as compared to alternative ones (Hooper and Mullen, 2008).

Descriptive analysis

As participants rated all survey items of the continuous variables, namely GHRM, in-role green innovative behavior and extra-role green innovative behavior, based on a five-point Likert scale, the authors interpreted their mean values based on Sekaran's and Bougie's (2016) criterion. The descriptive analysis revealed that GHRM ($M = 2.845$) and extra-role green innovative behavior ($M = 2.681$) were being practiced at a low level in the production departments. However, employees were practicing in-role green innovative behavior ($M = 3.518$) at a moderate level in the companies studied.

Measurement model analysis

In this study, the indicator loadings of all items were found to be in the range of between 0.654 and 0.843, above the cut-off value, i.e. 0.50. This means that all measurement items possess acceptable indicator reliability. The composite reliability (CR) of GHRM (0.784), extra-role green innovative behavior (0.877) and in-role green innovative behavior (0.826) were above 0.50 (Hair *et al.*, 2020). These CR values indicated their acceptable construct reliability. In addition, the average variance extracted values of GHRM (0.583), extra-role green innovative behavior (0.589) and in-role green innovative behavior (0.588) were also above 0.50. Therefore, these variables also possessed sufficient convergent validity (Hair *et al.*, 2020). Moreover, the square root of the AVE values of GHRM, extra-role green innovative behavior and in-role green innovative behavior were also higher than their respective correlation values (Table 1). Regarding the Fornell-Larcker Criterion, the variables had acceptable discriminant validity (Fornell and Larcker, 1981). The Heterotrait – Monotrait (HTMT) ratio also concluded with acceptable discriminant validity for GHRM, employee participation,

Table 1. Mean, CRs, AVE and correlation values

Construct	Mean	CR	AVE	1	2	3
1. GHRM	2.845	0.784	0.583	*0.764*		
2. Extra-role green innovative behavior	2.681	0.877	0.589	0.440	*0.767*	
3. In-role green innovative behavior	3.518	0.826	0.588	0.444	0.482	*0.767*

Note(s): *Italic values in diagonal indicate square root of respective AVE

Source(s): Authors' own work

extra-role green innovative behavior and in-role green innovative behavior as their ratios were lower than 0.90 (Table 2).

Hypotheses testing

First, the authors examined the impact of the control variables on in-role green innovative behavior and extra-role green innovative behavior. The data analysis concluded with a non-significant relationship between gender ($\beta = 0.021, \rho > 0.05$), age ($\beta = -0.026, \rho > 0.05$), company size ($\beta = 0.125, \rho > 0.05$), and the origin of a company's capital ($\beta = -0.148$, $\rho > 0.05$) and in-role green innovative behavior. In addition, gender ($\beta = 0.016, \rho > 0.05$), age ($\beta = 0.017, \rho > 0.05$), company size ($\beta = -0.088, \rho > 0.05$), and the origin of a company's capital ($\beta = -0.051, \rho > 0.05$) did not significantly relate to extra-role green innovative behavior. Following this, GHRM and employee participation were introduced into the main model. Path analysis demonstrated that GHRM positively and significantly influenced employees' in-role green innovative behavior ($\beta = 0.361, \rho < 0.05$) and extra-role green innovative behavior ($\beta = 0.380, \rho < 0.05$) (Table 3, Figure 2). Therefore, both hypotheses H1a and H1b were confirmed by the study. The employee participation*GHRM interaction term significantly and positively affected employees' in-role green innovative behavior ($\beta = 0.077, \rho < 0.05$) and extra-role green innovative behavior ($\beta = 0.084$, $\rho < 0.05$) (Table 3, Figure 2). This means that employee participation significantly moderated the relationship between GHRM and employees' in-role green innovative behavior and extra-role green innovative behavior. Hence, both hypotheses H2a and H2b were supported.

In addition, the empirical findings disclosed that the impact of GHRM on extra-role green innovative behavior ($\beta = 0.380$) was higher than on in-role green innovative behavior ($\beta = 0.361$). Similarly, the conditional impact of employee participation on the "GHRM –extra-role green innovative behavior" relationship ($\beta = 0.084$) was higher than on the "GHRM – in-role green innovative behavior" relationship ($\beta = 0.077$). The authors present the moderating impact of employee participation on the "GHRM – in-role green innovative behavior' and the "GHRM – extra-role green innovative behavior" relationship in graphical form, as shown in Figures 3 and 4 respectively. With an increasing level of employee participation, i.e. moving

Table 2. Heterotrait-monotrait ratio (HTMT) – Matrix

Construct	1	2	3	4
1. Extra-role green innovative behavior				
2. Employee participation	0.353			
3. GHRM	0.725	0.457		
4. In-role green innovative behavior	0.802	0.388	0.622	

Source(s): Authors' own work

Table 3. Hypotheses testing

Hypotheses	β	S.D	T-value	*P*-value	LLCI	ULCI
H1a: GHRM → In-role green innovative behavior	0.361	0.052	6.942	0.000	0.259	0.463
H1b: GHRM → Extra-role green innovative behavior	0.380	0.084	4.524	0.000	0.215	0.545
H2a: Employee participation*GHRM → In-role green innovative behavior	0.077	0.030	2.578	0.010	0.018	0.137
H2b: Employee participation *GHRM → Extra-role green innovative behavior	0.084	0.036	2.306	0.021	0.012	0.157

Source(s): Authors' own work

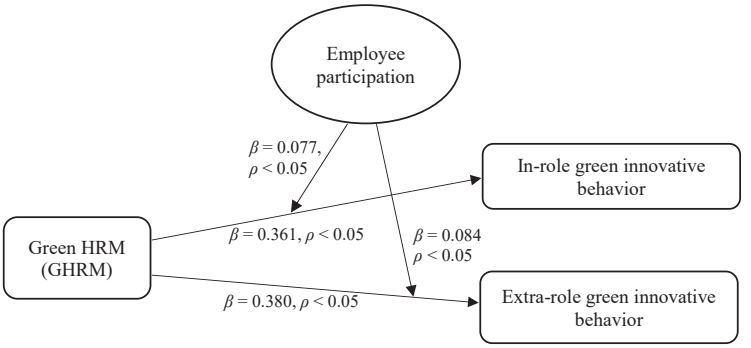

Figure 2. Structural model analysis. Source: Authors' own work

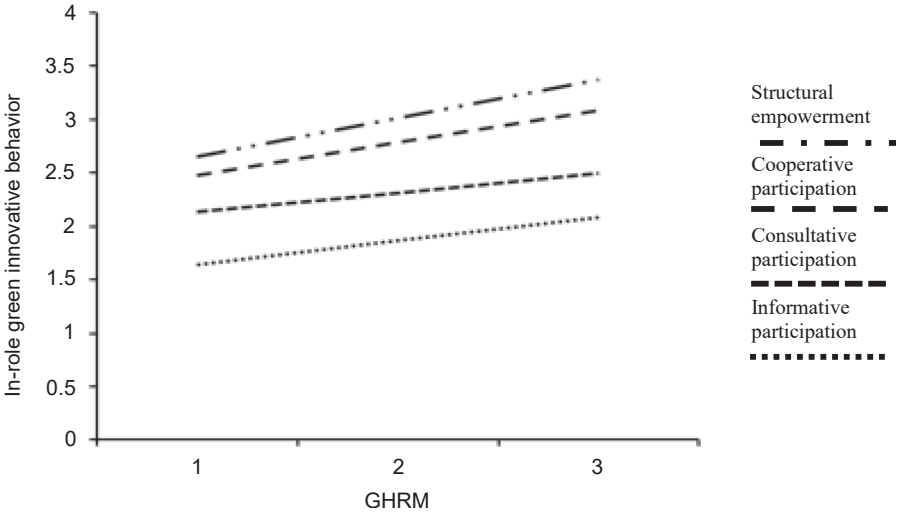

Figure 3. Impact of the interaction term (GHRM*employee participation) on in-role green innovative behavior. Source: Authors' own work

from informative participation to structural empowerment, there is a greater impact of GHRM on employees' in-role green innovative behavior and extra-role green innovative behavior.

Discussion

In the study, the authors tested a moderated model that linked GHRM with two types of employee green innovative behavior (in-role and extra-role), and drew on the concept of employee participation to propose moderation separately. All the proposed hypotheses were supported. Firstly, GHRM positively relates to in-role green innovative behavior (H1a). Secondly, there is evidence of a direct positive relationship between GHRM and extra-role green innovative behavior (H2b). Finally, in the moderation model, employee participation plays a positive role in both "GHRM – in-role green innovative behavior" (H2a) and "GHRM – extra-role green innovative behavior" (H2b) relationships. The impact of GHRM on both types of green innovative behavior is the highest in the presence of

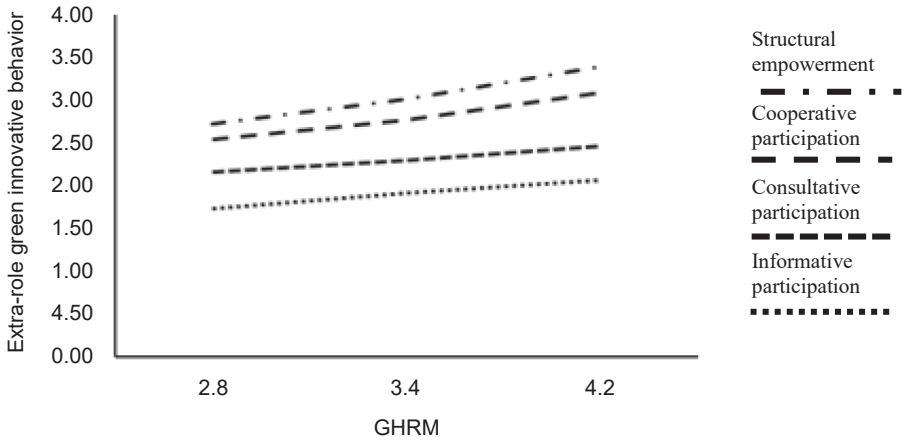

Figure 4. Impact of the interaction term (GHRM*employee participation) on extra-role green innovative behavior. Source: Authors' own work

structural empowerment. The main findings will be discussed below with regard to their theoretical and practical implications.

Theoretical implications

This study contributes to the literature on GHRM, employee participation and organizational behavior in various ways. Firstly, this study is the first to examine two types of employee green innovative behavior (in-role and extra-role), thus increasing the understanding of these behaviors. It significantly adds to previous studies on the antecedents to employee green behavior (Piwowar-Sulej and Kołodziej, 2022), with a particular focus on employee creativity (Liu *et al.*, 2024) and innovative behavior (Aboramadan, 2022). It responds to the call by Pham *et al.* (2019) to further examine the outcomes of GHRM. It extends the findings of previous studies presented in the literature review section, which have inconsistently shown the direct effect of GHRM on employee green behavior, including innovative behavior. It supports the findings of Shafaei and Nejati (2023), Yang and Li (2023), Aboramadan (2022) and Piwowar-Sulej *et al.* (2023), who demonstrated the positive impact of GHRM on green innovative behavior but without differentiating between in-role green innovative behavior and extra-role green innovative behavior.

Secondly, by utilizing SET (Blau, 1964), the authors have provided a theoretical explanation of how GHRM causes reciprocal behaviors in the form of in-role green innovative behavior and extra-role green innovative behavior. This finding supports previous conclusions based on SET on the positive role of GHRM in shaping employee green behavior (Piwowar-Sulej *et al.*, 2023), but simultaneously extends SET by suggesting that GHRM leads not only to general employee green behavior but also to two forms of specific green behaviors aimed at generating and implementing green ideas. It argues that companies that implement GHRM provide employees with valuable resources (e.g. rewards for engagement in green initiatives and environmental knowledge), thus making employees obligated to act eco-innovatively. At the same time, this study emphasizes that in-role green innovative behavior is the product of negotiated exchanges between employee and employer, whereas extra-role green innovative behavior emerges when employees feel supported and trusted by the organization.

Thirdly, the authors introduced employee participation as a complementary factor affecting the relationships between GHRM and two types of employee green innovative behavior. The research has shown a positive interaction between a substantial level of employee involvement in the decision-making process and GHRM that leads to the desired employee

behaviors. In this way, the study has revealed that employee participation is an additional positive factor that should be considered when building programs in support of both types of green innovative behavior. However, employee participation is a more important moderator in the case of extra-role green innovative behavior than of in-role green innovative behavior, which supports the claim by Choi *et al*. (2021) that extra-role behaviors need more autonomy and organizational support than in-role behaviors. From the SET perspective, one can state that when interacting with GHRM, employee participation provides employees with further valuable resources (at higher levels of employee participation associated with trust in employees' knowledge and creativity) that makes GHRM more effective in evoking reciprocating innovative behaviors. Although there is no other study on GHRM and employee green behaviors that examined structural empowerment as a moderator and can be used for comparison with our findings, this study can be said to extend the research of Saeed *et al*. (2019a), who found a direct role of structural empowerment in employee green behavior, and that of Tirno *et al*. (2023), who revealed a mediating role of structural empowerment between GHRM and general in-role and extra-role green behaviors.

The above finding supports most previous studies that considered employee participation a crucial element for fostering a positive work environment, enhancing employee engagement, and improving organizational performance (Mohsen and Sharif, 2020; Ullrich *et al*., 2023). However, at this point, it should be emphasized that research conducted by Philip and Arrowsmith (2020) concluded that increased participation does not necessarily translate into greater employee engagement. Even when participation is widespread and direct, the absence of appropriate policy and coordination frameworks can make it difficult to maintain control. In many instances, adopting a collective organizational approach failed to have a positive impact on motivation or overall organizational performance. Without a hierarchical or delegated authority structure, the decision-making process became erratic, excessively argumentative, and unclear. As our data show, this problem was not identified in the studied companies.

Practical implications

This paper's findings have important practical implications for business practitioners. Firstly, the adoption of eco-friendly advancements in both production methods and products has consistently been seen as an essential requirement for reducing the negative impact of the manufacturing sector on the environment. At the same time, employees' involvement in the exploration and discovery of imaginative environmentally friendly solutions, initiatives, and approaches aimed at reducing emissions, conserving energy, and fostering responsible waste management has been noted as an issue of the utmost importance (Begum *et al*., 2022). However, as our results indicate, in-role green innovative behavior is practiced at a moderate level, while extra-role green innovative behavior is practiced at a low level in the studied manufacturing companies. Therefore, there is a need for them to be stimulated.

Secondly, this study shows that GHRM can directly stimulate both in-role and extra-role green innovative behavior. Since it is also practiced at a low level, employers should put greater effort into introducing GHRM effectively. This involves a systematic approach to incorporating environmental sustainability into HR practices. Employers should introduce a GHRM policy that aligns with the company's sustainability goals. It is also important to make sure the leadership team understands the importance of GHRM and is committed to its implementation. HR training is treated as a crucially important GHRM practice in the subject literature as it increases employee environmental awareness (Piwowar-Sulej, 2021). Consequently, manufacturing companies should train employees in green manufacturing processes, waste management, and energy efficiency practices. In light of the expectations of Polish employees regarding the stimulation of their broadly defined green behaviors, manufacturing companies should also introduce incentives for sustainable practices, such as bonuses for reducing waste or saving energy (Piwowar-Sulej and Popowicz, 2023). Moreover, the GHRM system in manufacturing companies should be designed to achieve both horizontal

and vertical consistency (Piwowar-Sulej, 2022). Finally, after introducing GHRM practices, employers should conduct an audit to identify areas where changes can be made.

Thirdly, as Fortier and Albert (2015) emphasized, contemporary concepts of organizational management highlight the significance of individuals. Employees are expected to display professionalism, initiative, and creativity, often enjoying considerable decision-making authority. The results of this study suggest that to foster employee involvement in sustainability efforts, employers should encourage employees to come up with green ideas and initiatives. More independence and autonomy positively interact with GHRM and boost employee enthusiasm to bring new innovative value to the organization. Therefore, the companies under study should implement higher levels of employee participation related to green issues. In manufacturing settings, frameworks such as Kaizen are instrumental in engaging employees in continuous process improvement efforts. However, this requires additional effort because previous studies have shown that Polish employees are reluctant to take on decision-making responsibilities. They were particularly wary of being held accountable for their choices, especially when management was not prepared to share their power (Cierniak-Emerych and Piwowar-Sulej, 2017). Therefore, managers' and line employees' knowledge in this area should be increased to effectively implement employee participation. Moreover, organizations must position themselves as companies that provide all forms of support so as to enhance the use of participation by their employees.

Limitations and future research directions

Although this study offers valuable theoretical and practical implications, it is important to mention its limitations as a word of caution for future research. Firstly, a cross-sectional approach and a single source of data were used in the study. Future researchers could measure in-role green innovative behavior and extra-role green innovative behavior by asking managers, and include a time lag between reporting the independent and dependent variables. Secondly, as there may be differences in employee green innovative behavior between sectors, the authors suggest that future studies use samples from different sectors to compare the research model across industries. Thirdly, as rules of social exchanges can vary across cultures (Kempny, 1993), the study might be influenced by values inherent to Polish culture. To mitigate this potential bias, future researchers are encouraged to compare the findings of this study with those obtained in diverse cultural settings. Fourthly, the authors of this study collected data from medium-sized and large companies. Since previous research suggested that employees in smaller companies typically had a stronger perception of being involved in decision-making because smaller companies are less hierarchical and bureaucratic than larger organizations (Philip and Arrowsmith, 2020), future studies could also collect data from smaller companies. Fifthly, this study presents evidence supporting the impact of GHRM on in-role green innovative behavior and extra-role green innovative behavior. Future studies are recommended to explore the effect of other potential mechanisms, such as green internal branding (Srivastava *et al.*, 2020) and job satisfaction (Shafaei and Nejati, 2023), on their direct relationship. Sixthly, Fernandez and Moldogaziev (2013) found that while the level of employee empowerment increased employees' propensity to innovate, individual empowerment practices had contrary effects, and some of them discouraged employees' innovative behaviors. Therefore, future studies may extend our findings by examining individual participative practices. Finally, different psychological theories can be used to explain the impact of HRM practices on employee behavior. For instance, researchers could apply the ability-motivation-opportunity (AMO) theory to further extend the study's findings.

Conclusions

This study is the first to develop and test a research model comprising GHRM, two types of employee green innovative behavior (in-role and extra-role) and the conditional role of

employee participation. The empirical research conducted among medium-sized and large manufacturing companies in Poland showed that GHRM was the antecedent of two types of employee green innovative behavior, and that employee participation had a moderating role on the "GHRM – employee green innovative behaviors" relationships. Drawing on SET it was demonstrated that GHRM interacts with employee participation, providing employees with numerous resources, making them more likely to engage in green innovative behaviors. Although this study contributes to the GHRM, employee participation and organizational behavior research domains and provides several important practical implications, the authors hope that future researchers will overcome its limitations and extend the current findings, amongst others by examining various participative practices.

Appendix

Green Human Resource Management (GHRM)

(1) In my company, environmental objectives are set for all employees.

(2) My company offers environmental training for employees.

(3) My employer evaluates employees' green behavior within the HR appraisal system.

(4) My employer rewards employees' green behavior through financial incentives.

(5) My employer includes employees' green behavior in decisions related to career development.

In-role green innovative behavior
Within my formal job duties:

(1) I look for new ideas on environmentally friendly technologies, processes and products.

(2) I generate new ideas for environmental protection.

(3) I promote new environmental ideas among employees.

(4) I acquire and manage the resources needed to implement new environmental ideas.

(5) I prepare schedules for the implementation of new environmental ideas.

Extra-role green innovative behavior
Outside of my formal job duties:

(1) I look for new ideas on environmentally friendly technologies, processes and products.

(2) I generate new ideas for environmental protection.

(3) I promote new environmental ideas among employees.

(4) I acquire and manage the resources needed to implement new environmental ideas.

(5) I prepare schedules for the implementation of new environmental ideas.

Note

1. At this point, it is worth emphasizing that researchers also use the notion of green innovation behavior. Some of them (e.g. Yang and Li, 2023) focus on employee behavior, whereas others (e.g. Long *et al.*, 2017; Xie and Zhu, 2020) examine organizational activities rather than individual employee behaviors.

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