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RESEARCH ARTICLE

Analysis of factors affecting the implementation of green human resource management using a hybrid fuzzy AHP and type-2 fuzzy DEMATEL approach

Ebrahim Rajabpour[1] · Mohammad Reza Fathi[2] · Mohsen Torabi[3]

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Abstract
The topic of green human resource management has attracted considerable attention during this last decade. Despite this interest, little research has been conducted to explore the successful implementation of green human resource management to achieve environmental sustainability goals. Therefore, this study aims to identify the factors affecting the effective implementation of green human resource management in petrochemical companies in Bushehr City. This research is the first article that has evaluated green human resource management measures in petrochemical industries, and on the other hand, it can be stated that it is the first paper to perform green measures of human resource management using the combined method of fuzzy hierarchical analysis and type-2 fuzzy DEMATEL. The present study seeks to identify these factors and examine their relationships based on existing theoretical foundations and expert opinions. Based on results, factors affecting green human resource management implementation were divided into five categories: recruitment and employment, training and development, performance appraisal, service compensation and reward, and green organizational culture management. In other words, a total of five criteria and twenty green sub-criteria were identified for the implementation of green human resource management. Fuzzy AHP and type-2 fuzzy DEMATEL were applied to determine the weights of the criteria. The results showed that the process of green training and development is the most critical factor in the effective implementation of green human resource management. Also, training and development processes, service compensation, and green organizational culture management are affecting factors to achieve this critical issue. In order to implement green human resource management, this study has proposed the priority of green measures for petrochemical industry managers.

Keywords Sustainability management · Environmental management · Green human resource management · GHRM · Green organizational culture management · Type-2 fuzzy DEMATEL

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✉ Mohammad Reza Fathi
Reza.fathi@ut.ac.ir

Ebrahim Rajabpour
E.rajabpour@pgu.ac.ir

Mohsen Torabi
Mohsentoraby89@gmail.com

1 Department of Business Administration, Faculty of Business and Economics, Persian Gulf University, Bushehr, Iran

2 Department of Management and Accounting, College of Farabi, University of Tehran, P.O. Box 3718117469 Qom, Iran

3 Department of Public Management (Policy Making), University of Hormozgan, Bandar Abbas, Iran

Introduction

Globally, environmental researchers and policymakers around the world agree on the reasons for the deteriorating environmental situation. Resource scarcity, increasing pollution, and biodiversity loss are rooted in human behavior (Mtutu & Thondhlana, 2016; Anwar et al., 2020). In response, many organizations try to implement environmental management systems or green initiatives to make their day-to-day operations less harmful to the environment (Fawehinmi et al., 2020; Marrucci et al., 2021). In fact, in this situation, all organizations are obliged to make more efforts to adapt their economic and social actions to environmental issues, especially organizations with social, competitive, and regulatory pressures. Achieving this balance has become a problem and, in some cases, a controversial

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challenge (Zaid et al., 2018; Gusmerotti et al., 2020). Hence, a new need has come into existence to understand and shape the behavior of employees so that their activities have the most negligible negative impact on the environment. Since adopting environmental management methods has become a new organizational goal, supporting human resource management (HRM) functions is essential for adopting environmental management practices (Rajabpour, 2017). Therefore, in response to these concerns, the role of green human resource management (GHRM) has emerged as a new subject in environmental studies for influencing the green behavior of employees in the workplace (Dumont et al. 2017). The issue of GHRM has been welcomed by researchers interested in examining how environmental sustainability works in organizations because the implementation of the greening process cannot be done successfully without integrating human resource (HR) practices dedicated to environmental issues (Paillé et al., 2020).

GHRM involves awareness and application of environmental components throughout the HRM process: hire, train, reward, and develop a green workforce to understand and value environmentally friendly practices (Anwar et al., 2020). In addition, contemporary researchers who support HRM in environmental performance emphasize the environmentally friendly behavior of employees as an essential factor in the successful implementation of environmental policies in the workplace (Kim et al., 2017). GHRM provides a competitive advantage in achieving environmental performance (Masri & Jaaron, 2017, Benevene and Buonomo 2020). In addition to achieving economic stability and environmental balance, GHRM also contributes to the sustainability of social justice, health, and welfare and improves the organization's performance and its employees (Amrutha & Geetha, 2020). Also, greening an organization affects the overall value chain of the organization. Production, waste management, culture, values, strategies, and behaviors of employees are just a few examples that can be mentioned (Nisar et al., 2021). Previous studies have been examined the impact of GHRM on employees' behavior (Pham et al., 2020); Environmental performance (Kim et al., 2019), and financial performance (O'Donohue & Torugsa, 2016).

It can be acknowledged that all the advances and technologies achieved in human history are the product of human creativity and innovation. Therefore, the real wealth of any organization is its human resources. Hence, the greenness and sustainability of human resources will lead to resource sustainability in an organization (Amrutha & Geetha, 2020). In order to maintain the social legitimacy of the organization, its current and potential human resources are needed, and this indicates the use of sustainable HR. Some other organizations have sought to reduce staffing and sacrifice HR to diminish costs; this indicates the social irresponsibility of organizations (Tooranloo et al., 2017; Úbeda-García et al., 2021). In recent years, to create and maintain a green approach, organizations have used some facilitators in HR such as recruitment, training, rewarding, and developing the workforce, compensation, and green culture. They have significantly increased HR productivity and productivity. Various studies have been conducted on GHRM and its relationship with other human and organizational variables. However, no coherent studies have been conducted on the factors affecting the successful implementation of GHRM in organizations. Therefore, this study aims to investigate the factors affecting the successful implementation of GHRM in the petrochemical industry and weigh and determine the causalities of these factors.

Research theoretical foundations

Green human resource management

According to Ability-Motivation-Opportunity (AMO) theory, the most crucial theory in understanding the impact of HRM functions on organizational performance, the greening of HRM, and environmental outcomes can be better understood. The theory explains that high-performance work systems are distinct but interconnected HRM practices were grouped based on three main aspects: ability, motivation, and opportunity (Amrutha & Geetha, 2020). Abilities are based on practices, including recruitment and selection, training, and development programs that ensure employees have the knowledge and skills needed to perform specific tasks. Motivation is based on practices such as performance appraisal and financial and nonfinancial incentives that are intended to strengthen employees' efforts to achieve goals. Finally, an opportunity is a set of practices including participation, knowledge sharing, and ways to increase independence that enhance employees' participation in activities (Marin-Garcia & Tomas, 2016).

Integrating HRM and environmental management was unknown until Renwick et al. (2008) addressed it. Since then, this emerging field has been named "green HRM" and drew more researchers' attention to work more regularly on it and focus more on environmental issues in their studies (Rajabpour et al. 2020). According to Ren et al. (2018), when the general practices of HRM are aligned with environmental protection policies, a new criterion of HRM appears as "green HRM." Green HR includes a set of policies and methods to support the organizational workforce and maintain knowledge capital by adopting the best ways to be environmentally friendly and reduce their costs (Ren et al., 2018). Greening all functional HRM activities has been done by using sustainable methods and policies to strengthen the morale and satisfaction of employees to use the limited resources available and protect the environment

(Mustapha et al., 2017). HRM policies and practices such as recruitment, selection, training, evaluation, payment, service compensation, reward, and employee relations (Renwick et al., 2013) have become a powerful tool for aligning employees with organizational environmental strategies leading to long-term sustainable performance (Amrutha & Geetha, 2020). Table 1 lists some of the definitions of GHRM.

According to the definitions and theoretical literature review, it is found that most studies have mentioned five criteria in the GHRM definition, including green recruitment and selection (GRS), green training and development (GTD), green performance management system (GPS), green pay and reward system (GPR), and green management of organizational culture (GOC).

Green recruitment and selection (GRS)

Traditionally, selecting and hiring the best employees for the organization focuses only on applicants who can perform the desired job responsibilities and perform better among several other applicants (Ramasamy et al., 2017). However, to create a green workplace, the organization must consider green criteria and environmental items in selecting and hiring human resources (Renwick et al., 2013). The main characteristics of green recruitment and selection include recruiting applicants with knowledge and awareness of environmental issues (Gupta, 2018; Tang et al., 2018), green brand to attract green employees (Tang et al., 2018), prioritizing applicants who choose green criteria (Paillé et al., 2020; Tang et al., 2018), and internal staff's preference with green capabilities to fill vacancies (Gupta, 2018).

Green training and development (GTD)

Training is an essential skill set that helps employees improve their knowledge and cause their creativity and innovation. However, due to growing environmental issues, organizations are more inclined to give green training to their employees. Green training enables employees to acquire specific skills to participate in the organization's environmental issues and pay more attention to environmental

Table 1 GHRM definitions

Authors	Definitions
Renwick et al., 2013	GHRM can be defined as aspects of HRM aligned with environmental management
Masri and Jaaron, 2017	GHRM refers to HRM practices to strengthen environmentally sustainable practices and enhance employees' commitment to environmental issues
Nejati et al., 2017	GHRM equips organizations with environmentally conscious, respectful, and committed employees who can help the organization minimize carbon footprint by making effective and efficient use of available resources, including communication tools, less paper printing, business sharing, and video conferencing
Zaid et al., 2018	GHRM software package can be considered a coherent set of human resources, which has consequences for manufacturing companies such as green employment, green training and participation, performance management, and compensation for green services
Ren et al., 2018	GHRM is a phenomenon related to understanding organizational activities and their effect on the environment, evident in the design, development, and implementation of HRM systems
Tang et al., 2018	GHRM includes a set of environmental protection policies and practices such as green recruitment and selection, green education, green performance management, green compensation and rewards, and green participation
Wikhamn, 2019	GHRM is adopting HRM strategies and practices that enable financial, social, and environmental goals within and outside the organization over a long time and controlling the unintended side effects and negative feedback
Yusliza et al., 2019	Green human resource management is considered as a complete package including the dimensions of analysis and description of green job position, green employment and selection, green education, green performance and green reward, and green culture, which must be implemented by senior management of the organization
Anwar et al., 2020	GHRM involves awareness and applying environmental components into the HRM process, including hiring, training, rewarding, and developing green labor that understands environmentally friendly values and practices
Amrutha and Geetha, 2020	GHRM refers to all activities related to developing, implementing, and ongoing maintenance of a system that aims to green procedures and employees. It is the aspect of HRM that is interested in transforming ordinary employees into green employees and ultimately making a significant contribution to environmental sustainability
Rubel et al., 2021	Human resource management refers to the tasks of human resource management as green responsibilities in developing the core functions of human resources to receive beliefs, knowledge, attitudes, and behaviors related to the employee environment
Muisyo and Qin, 2021	Green human resource management refers to ways that are designed to create pro-environmental values and behaviors in the company's workforce and can be used to create employees who can improve green performance
Haldorai et al., 2022	Green human resource management is defined as responding to the organization's vital need to expand the role of human resource management in pursuing environmentally friendly business operations

developments, thereby meeting the organization's goals (Tang et al., 2018). Green education is the most important way HRM can fulfill the environmental goals of organizations and help the organization move toward a more sustainable organization (Paillé et al., 2020). The main features of green education and development are the development of specific training plans in environmental management for employees (Masri & Jaaron, 2017; Tang et al., 2018), green knowledge management initiatives (Tang et al., 2018), providing all educational materials online to reduce paper costs (Masri & Jaaron, 2017), and involving employees in solving environmental problems (Gupta, 2018).

Green performance management system (GPS)

This component refers to an employee's performance evaluation system with environmental management capabilities (Gupta, 2018). HR managers use green job rankings as a criterion to evaluate employees' job performance related to environmental issues and thus help improve the organization's environmental goals by monitoring and evaluating employees' behavior and performance (Sharma & Gupta, 2015). The main features of green performance management system include the use of green performance criteria when evaluating (Sharma & Gupta, 2015; Tang et al., 2018), setting green goals and objectives for employees (Masri & Jaaron, 2017), negative assessment for non-compliance with environmental goals (Nejati et al., 2017; Tang et al., 2018), and employee evaluation after attending green training courses (Nejati et al., 2017).

Green pay and reward system (GPR)

The green payment and reward system is a tool to encourage employees toward the organization's environmental goals through financial and non-financial rewards. It is also an attempt to prevent the departure of talented employees and attract new employees familiar with green methods. Modern organizations adopt this approach to strategically reward employees who strive to achieve the environmental goals of the organizations (Ramasamy et al., 2017). The main features of green service compensation are providing green travel benefits to employees (Renwick et al., 2013; Tang et al., 2018), financial incentives and tax cuts (Gupta, 2018), Green Award for Environmental Management (Masri & Jaaron, 2017; Nejati et al., 2017), and Awards for Innovative Environmental Proposals (Masri & Jaaron, 2017; Gupta, 2018).

Green management of organizational culture (GOC)

Organizational culture is defined as organizational norms and expectations about how people behave and do things in an organization (Upadhyay & Kumar, 2020). In this regard, the environmental culture of the organization includes a set of assumptions, values, symbols, and artifacts of the organization that indicate the desire or necessity of a desirable organization in terms of environmental management (Gupta, 2018). Green culture and commitment to the organization are essential tools for achieving the goals of organizational sustainability. Understanding and adopting a green culture helps the organization be committed to people, green initiatives, and the organization's goals (Ramasamy et al., 2017).

A company without a green culture will face many problems in implementing the green abilities, motivations, and opportunities of its employees. The role of green innovation culture is often very clear in the human resource management literature. However, there is a lack of studies in the field of green culture management (Muisyo & Qin, 2021). Numerous studies have shown that research on how green projects are implemented by environmentally conscious staff in the absence of green culture is flawed (Dubey et al., 2017; Marrucci et al., 2021; Sharma et al., 2021; Haldorai et al., 2022; Darvishmotevali & Altinay, 2022). The main features of the green management of organizational culture are creating formal and informal communication channels for the development of green culture (Tang et al., 2018), the support of senior executives for green activities (Masri & Jaaron, 2017), the organizational missions' emphasis on environmental issues (Gupta, 2018; Paillé et al., 2020), and improving employee's health and safety (Gupta, 2018). The main criteria and sub-criteria affecting the implementation of the GHRM are summarized in Table 2.

Research methodology

In terms of philosophical foundations, this research falls into the category of positivist paradigm. In terms of research orientation, it is applied research. The method of conducting research is quantitative. In this study, the methods of data collection were library studies, focus groups, and questionnaires. University professors and petrochemical industry experts completed the questionnaires. According to the purpose of this research, the literature review and expert surveys were used to identify the factors. Accordingly, a total of 20 sub-criteria, five main criteria were identified. Based on the identified factors, the research hierarchy tree was drawn (Fig. 1). According to the experts' views in the second and third levels of this tree, there are five criteria and 20 sub-criteria affecting the successful implementation of the GHRM, which interact with each other. A hybrid fuzzy AHP and type-2 fuzzy DEMATEL approach were used to determine the weights of criteria and sub-criteria. The pairwise comparison evaluation of fuzzy AHP and type-2 fuzzy DEMATEL are the two MCDM methods that could be integrated

Table 2 Main criteria and sub-criteria affecting the implementation of GHRM

Criteria	Sub-criteria	References
Green recruitment and selection (GRS)	Recruitment of applicants with knowledge and awareness of environmental issues (GRS1)	Ahmad, 2015; Shen et al., 2016; Masri and Jaaron, 2017; Nejati et al., 2017; Tang et al., 2018; Gupta, 2018
	Green brand to attract green employees (GRS2)	Ehnert, 2009; Kapil, 2015; Longoni et al., 2016; Tang et al., 2018
	Prioritize applicants who choose green criteria (GRS3)	Renwick et al., 2013; Willness and Jones, 2013; Tang et al., 2018; Paillé et al., 2020
	Preference of internal staff with green capabilities to fill vacancies (GRS4)	Renwick et al., 2013; Nejati et al., 2017; Gupta, 2018
Green training and development (GTD)	Development of specific training programs for employees in the field of environmental management (GTD1)	Longoni et al., 2016; Masri and Jaaron, 2017; Tang et al., 2018; Gupta, 2018
	Green knowledge management initiatives (GTD2)	Renwick et al., 2013; Tang et al., 2018; Gupta, 2018
	Providing all educational materials online to reduce paper costs (GTD3)	Kapil, 2015; Masri and Jaaron, 2017; Ullah, 2017
	Employee involvement in environmental solutions (GTD4)	Longoni et al., 2016; Gupta, 2018; Paillé et al., 2020
Green performance management system (GPS)	Use of green performance criteria when evaluating performance (GPS1)	Renwick et al., 2013; Kapil, 2015; Sharma and Gupta, 2015; Tang et al., 2018
	Set green goals and objectives for employees (GPS2)	Longoni et al., 2016; Masri and Jaaron, 2017; Nejati et al., 2017; Tang et al., 2018
	Negative assessment for non-compliance with environmental objectives (GPS3)	Renwick et al., 2013; Nejati et al., 2017; Tang et al., 2018; Gupta, 2018
	Employee evaluation after attending green training courses (GPS4)	Teixeira et al.2016; Nejati et al., 2017; Gupta, 2018
Green pay and reward system (GPR)	Benefits of green travel for employees (GPR1)	Jackson et al., 2011; Renwick et al., 2013; Gupta, 2018; Tang et al., 2018
	Financial incentives and tax reduction (GPR2)	Jabbour and Santos, 2008; Renwick et al., 2013; Kapil, 2015; Arulrajah et al., 2016; Gupta, 2018
	Green Award for Environmental Management (GPR3)	Masri and Jaaron, 2017; Nejati et al., 2018; Gupta, 2018
	Awards for Innovative Environmental Proposals (GPR4)	Renwick et al., 2013; Masri and Jaaron, 2017; Gupta, 2018
Green management of organizational culture (GOC)	Establish formal and informal communication channels to promote green culture (GOC1)	Tang et al., 2018; Gupta, 2018; Paillé et al., 2020; Marrucci et al., 2021
	Senior support for green activities (GOC2)	Masri and Jaaron, 2017; Gupta, 2018; Sharma et al., 2021; Haldorai et al., 2022
	The emphasis of the organizational missions on environmental issues (GOC3)	Masri and Jaaron, 2017; Gupta, 2018; Paillé et al., 2020; Darvishmotevali and Altinay, 2022
	Improving employees' health and safety (GOC4)	O'Donohue and Torugsa, 2016; Gupta, 2018; Muisyo and Qin, 2021; Haldorai et al., 2022

to develop a new model. Previously, Chou et al. (2012) had developed the integration of fuzzy AHP and fuzzy DEMATEL. The fuzzy AHP was adopted to find weights of the criteria whereas the fuzzy DEMATEL was adopted to capture the complex relationship between dimensions and criteria. The two methods were used separately with two different purposes, and there was no clear integration between the methods. The weights obtained from fuzzy AHP were meant for improving staff management in a short period, and the relationships were used for improving in a long run. The fuzzy AHP used was totally unrelated to fuzzy DEMATEL and vice versa. They only divided the methods into short-term period solution and long-term period solution, and their method was just the same as single approach of fuzzy AHP and fuzzy DEMATEL without having any integration between these two methods. Therefore, we attempt to merge the fuzzy AHP and type-2 fuzzy DEMATEL to become an integrated method. The two methods are now being applied

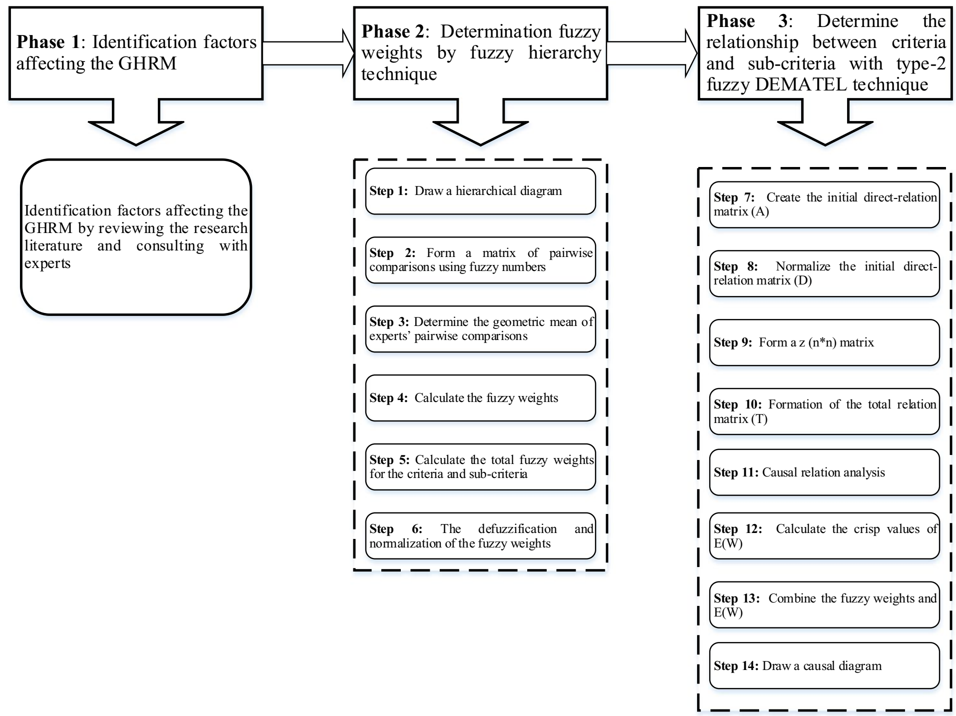

Fig. 1 Research process framework

by introducing weight obtained from fuzzy AHP to type-2 fuzzy DEMATEL. The intended integration method is basically hybridizing the two methods where the output from the first method is used as a multiplying factor to the computational steps of the second method.

In the following, the methods used in the research are described:

Phase 1: this stage identifies factors affecting the GHRM by reviewing the research literature and consulting with experts.

Phase 2: this determines fuzzy weights by fuzzy hierarchy technique. Analytic hierarchy process (AHP) is a decision-making method to solve complex multi-criteria problems (Abdullah & Zulkifli, 2015). In the hierarchical analysis technique, the evaluation of complex problems consists of different layers, decomposing them into different layers. This method allows decision-makers to express their priorities and opinions in the form of fuzzy numbers and incorporate uncertainty into their judgments (Tooranloo et al., 2017). In this research, the fuzzy hierarchical method has been used to determine the weight of the criteria, and its fuzzy numbers are trapezoidal type.

Step 1: *draw a hierarchical diagram*: the hierarchical structure consists of three levels, the upper level is the criteria, and the lower level is the sub-criteria.

Step 2: *form a matrix of pairwise comparisons using fuzzy numbers*: in this step, based on Fig. 2, experts were asked to express their views on the pairwise comparisons of the factors affecting the implementation of the GHRM using the verbal expressions (Table 3).

After gathering experts' views and converting verbal data into fuzzy numbers, a matrix of pairwise comparisons is formed using Eq. (1).

$$\tilde{A} = \begin{bmatrix} 1 & \tilde{a}_{12} & \dots & \tilde{a}_{1n} \\ \tilde{a}_{21} & 1 & \dots & \tilde{a}_{2n} \\ . & . & \ddots & . \\ . & . & & . \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} 1 & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ 1/\tilde{a}_{21} & 1 & \cdots & \tilde{a}_{2n} \\ . & . & \ddots & . \\ . & . & & . \\ 1/\tilde{a}_{n1} & 1/\tilde{a}_{n2} & \cdots & 1 \end{bmatrix} \tag{1}$$

Step 3: *determine the geometric mean of experts' pairwise comparisons*: the geometric mean of experts' pairwise comparisons is obtained using Eq. (2).

$$a_{ij} = \left(a_{ij}^1 \times a_{ij}^2 \times \cdots \times a_{ij}^n\right)^{\frac{1}{n}} \tag{2}$$

Step 4: *calculate the fuzzy weights*: the mean matrix of pairwise comparisons of each criterion is obtained using Eq. (3).

$$\tilde{a}_j = \left(\tilde{a}_{m1}^1 \times \tilde{a}_{m2}^2 \times \cdots \times \tilde{a}_{mn}^n\right)^{\frac{1}{n}} \tag{3}$$

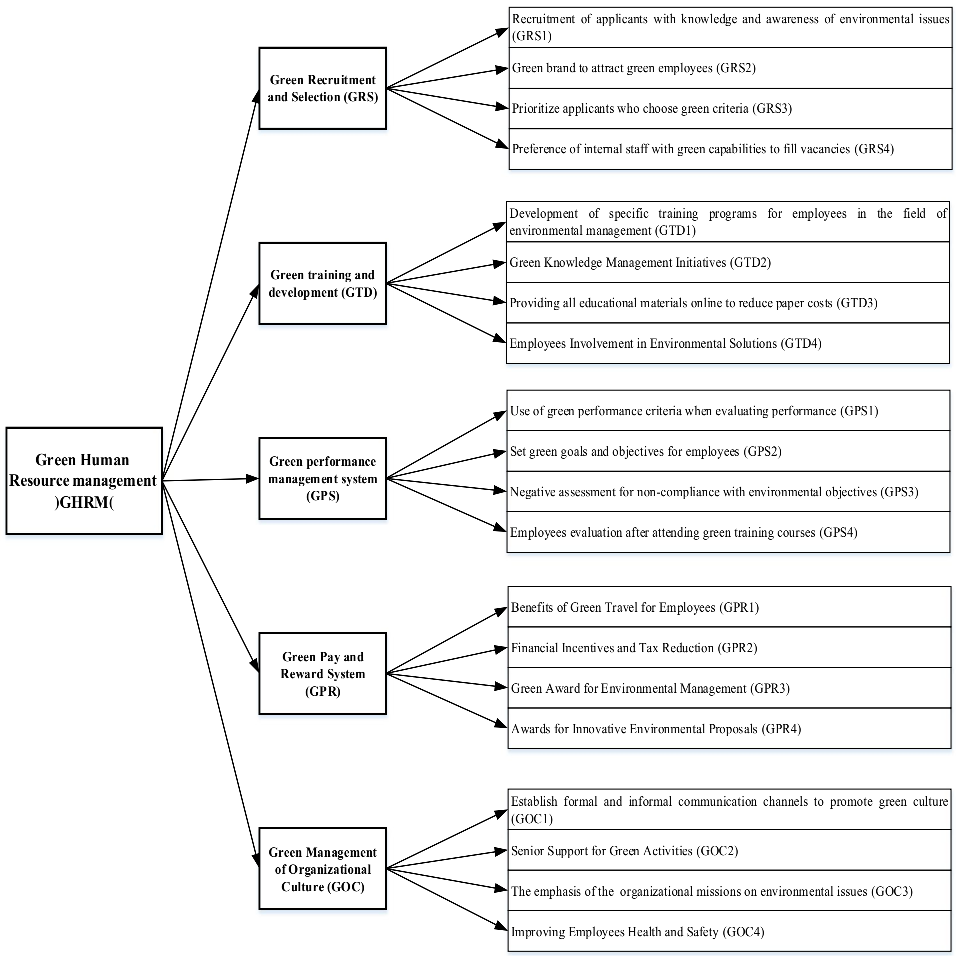

Fig. 2 The hierarchical tree of factors affecting GHRM implementation

Table 3 Linguistic scales for trapezoidal pairwise comparisons (Zheng et al., 2012)

Inverse trapezoidal fuzzy scales	Trapezoidal fuzzy scales	The numerical scale of the relative importance of fuzzy numbers	Linguistic values for pairwise comparisons
(1, 1, 1, 1)	(1, 1, 1, 1)	1	Equal importance
(0.333, 0.4, 0.666, 1)	(1, 1.5, 2.5, 1)	2	Medium importance
(0.25, 0.222, 0.4, 0.5)	(2, 2.5, 3.5, 4)	3	Relatively more important
(0.2, 0.222, 0.285, 0.333)	(3, 3.5, 4.5, 5)	4	Medium importance
(0.166, 0.181, 0.222, 0.25)	(4, 4.5, 5.5, 6)	5	Much more important
(0.142, 0.153, 0.181, 0.2)	(5, 5.5, 6.5, 7)	6	Medium importance
(0.125, 0.133, 0.153, 0.166)	(6, 6.5, 7.5, 8)	7	Strongly more important
(0.111, 0.117, 0.133, 0.142)	(7, 7.5, 8.5, 9)	8	Medium importance
(0.111, 0.111, 0.117, 0.125)	(8, 8.5, 9, 9)	9	More importantly

j is the number of criteria, and *m* is a fuzzy number. The fuzzy weight of each index is obtained from Eq. (4), where *n* is the number of experts.

$$\tilde{w}_j = \tilde{a}_j * \left(\tilde{a}_1 + \tilde{a}_2 + \cdots + \tilde{a}_n\right)^{-1} \quad (4)$$

Step 5: *calculate the total fuzzy weights for the criteria and sub-criteria*: complete fuzzy weights are obtained by multiplying the weights obtained from the criteria into the weight of the criteria (Eq. (5)).

$$T\tilde{w}_j = D\tilde{w}_j * C\tilde{w}_j \quad (5)$$

Step 6: *the defuzzification and normalization of the fuzzy weights*: Eq. (6) is used to normalize the fuzzy trapezoid weights.

$$W_j = \frac{1}{3}\left[a + b + c + d - \frac{dc - ab}{(d + c) - (a + b)}\right] \tag{6}$$

Phase 3: relationship between criteria and sub-criteria with type-2 fuzzy DEMATEL technique: the DEMATEL method was first proposed by Fontella and Gabus (1976). This technique is one of the types of decision-making methods based on pairwise comparisons. This technique examines the interrelationships between criteria, influence, and importance as a numerical score (Tooranloo et al., 2017). The most crucial feature of the DEMATEL method is multi-criteria decision-making and its performance in building relationships and structure between factors. In addition to transforming cause-and-effect relationships into a structural-visual model, this technique can identify the internal dependencies between factors and make them understandable. In general, however, it is challenging to estimate experts' views with accurate numerical values, especially in uncertainties; this factor has led to the need for fuzzy DEMATEL. As a result, the DEMATEL technique uses the second type of fuzzy linguistic variables that facilitate decision-making in environmental uncertainties (Abdullah & Zulkifli, 2015). The steps of this technique are as follows (Tooranloo et al., 2017):

Step 7: *create the initial direct-relation matrix (A)*: in this step, a questionnaire related to the influence level of each criterion to other sub-criteria is prepared and distributed among experts. After collecting experts' views, the verbal data is converted into fuzzy numbers, and the initial direct-relation matrix is determined using Eq. (7). It should be noted that the second type of fuzzy linguistic variables and the influence level of the criteria are shown in Table 4.

$$A_{ij} = \frac{1}{H}\sum_{k=1}^{H} x_{ij}^{k} \tag{7}$$

Step 8: *normalize the initial direct-relation matrix (D)*: the normalized initial direct-relation matrix s (*D*) is obtained using Eqs. (8) and (9).

$$D = \frac{A}{S} \tag{8}$$

$$S = \max\left(\begin{matrix} max \\ 1 \le j \le n \end{matrix} \sum_{j=1}^{n} A_{ij}, \begin{matrix} max \\ 1 \le i \le n \end{matrix} \sum_{i=1}^{n} A_{ij}\right) \tag{9}$$

Step 9: *form a z (n*n) matrix*: the *Z* matrix is created by adjusting the *N* matrix according to the membership functions.

$$Z_x = \begin{bmatrix} 0 & x_{12} & \dots & x_{1n} \\ x_{21} & 0 & \dots & x_{2n} \\ . & . & \ddots & . \\ . & . & & . \\ x_{n1} & x_{n2} & \cdots & 0 \end{bmatrix} \tag{10}$$

Step 10: *formation of the total relation matrix (T)*: the total relation matrix of the criteria is obtained using Eq. (11), in which "*I*" is the identity matrix.

$$T_x = Z_x(I - Z_x)^{-1} \tag{11}$$

Step 11: *causal relation analysis*: the sum of the values of rows and columns is obtained to analyze the causal relationships and determine $D + R$ and $D - R$ values.

$$T_x = \left[t_{ij}\right]_{n\times n} \; i,j = 1, 2, \dots, n \tag{12}$$

$$r_x = \left[\sum_{j=1}^{n} t_{ij}\right]_{n\times 1 = [t_i] n\times 1} \tag{13}$$

$$c_x = \left[\sum_{j=1}^{n} t_{ij}\right]_{1\times n = [t_i] 1\times n} \tag{14}$$

Table 4 Linguistic scales for trapezoidal pairwise comparisons (Abdullah & Zulkifli, 2015)

Type-2 fuzzy trapezoidal scales	Numerical scale	Linguistic values for the influence level
((0.8, 0.9, 0.9, 1, 1, 1), (0.85, 0.9, 0.9, 0.95, 0.9, 0.9))	5	Extreme impact
((0.6, 0.7, 0.7, 0.8, 1, 1), (0.65, 0.7, 0.7, 0.75, 0.9, 0.9))	4	High impact
((0.4, 0.5, 0.5, 0.6, 1, 1), (0.45, 0.5, 0.5, 0.55, 0.9, 0.9))	3	Low impact
((0.2, 0.3, 0.3, 0.4, 1, 1), (0.25, 0.3, 0.3, 0.35, 0.9, 0.9))	2	Very little impact
((0, 0.1, 0.1, 0.1, 1, 1), (0, 0.1, 0.1, 0.05, 0.9, 0.9))	1	Without impact

Step 12: *calculate the crisp values of E(W)*: the expected values of $E(D_i+R_i)$ and $E(D_i-R_i)$ are obtained using Eqs. (15) and (16).

$$E(W) = \frac{1}{2}\left(\frac{1}{4}\sum_{i=1}^{4}\left(w_i^l + w_i^u\right)\right) \times \frac{1}{4}\left(\sum_{i=1}^{2}\left(w_i\left(A^l\right) + w_i\left(A^U\right)\right)\right) \quad (15)$$

$$w_i = \left(w_i^u + w_i^l\right) = \begin{pmatrix} \left(w_1^u, w_2^u, w_3^u, w_4^u; H_1\left(w_i^u\right), H_2\left(w_i^u\right)\right), \\ \left(w_1^L, w_2^L, w_3^L, w_4^L; H_1\left(w_i^L\right), H_2\left(w_i^L\right)\right) \end{pmatrix} \quad (16)$$

Step 13: *combine the fuzzy weights and E(W)*: it is calculated using Eq. (17).

$$E(W)\text{new} = w_j \times E(W) \quad (17)$$

Step 14: *draw a causal diagram*: the horizontal axis of the vector $(D_i+R_i($ is called the influence and indicates the importance degree of criterion i in the system. The vertical axis of the vector $(D_i-R_i($ is called the dependence and represents the net effect of the system on criterion i.

The research process framework is shown in Fig. 1.

Findings

In the present study, the results obtained from data collection are presented in three phases:

Phase 1: identify factors affecting the GHRM: first, the GHRM criteria and sub-criteria were identified by reviewing the research literature and the university and petrochemical industry HR experts' views. For finalizing the criteria and sub-criteria, a focus group consisting of experts familiar with the subject of the study was held. In the end, five main criteria and twenty sub-criteria were entered into the research process for further investigation.
Phase 2: determine the fuzzy weights using the fuzzy AHP technique: the results of this phase are presented in the following steps:
Step 1: *draw a hierarchical tree*: according to the factors identified in the first phase, the hierarchical tree is illustrated in Fig. 2.
Step 2: *formation of pairwise comparison matrix using fuzzy numbers*: the linguistic expressions are converted to fuzzy numbers using the hierarchy tree and Table 3. Then, the pairwise comparison matrix is formed using Eq. (1).
Step 3: *determine the geometric mean matrix of experts' pairwise comparisons:* the geometric mean of experts' pairwise comparisons is obtained using Eq. (2). Table 5 shows the geometric mean matrix of experts' pairwise comparisons related to the GHRM criteria. The main criteria are indicated by the symbol C.

Step 4: *calculate the fuzzy weights*: the fuzzy weights of criteria and sub-criteria are calculated using Eqs. (3) and (4). Table 6 shows these calculations.

The results of Table 6 show that "green training and development" (C2) with weight 0.365 is the primary process of the GHRM in the study's statistical population. Then, "green management of organizational culture" (C5), "green pay and reward system" (C4), "green performance management system" (C3), and "green recruitment and selection" (C1) are placed in the subsequent ranks, respectively.

Table 5 Geometric mean matrix of experts' pairwise comparisons

	C1				C2				C3				C4				C5			
C1	1	1	1	1	0.37	0.42	0.57	0.68	0.46	0.48	0.55	0.61	0.29	0.33	0.41	0.46	0.15	0.17	0.20	0.23
C2	1.47	1.75	2.36	2.74	1	1	1	1	3.91	4.42	5.45	6.02	2.75	3.26	4.28	4.78	1.35	1.54	1.84	1.98
C3	1.65	1.80	2.07	2.20	0.17	0.18	0.23	0.26	1	1	1	1	0.89	0.77	0.96	1.07	0.35	0.41	0.54	0.65
C4	2.20	2.46	3.06	3.46	0.21	0.23	0.31	0.36	0.93	1.04	1.29	1.12	1	1	1	1	0.49	0.60	0.85	1.02
C5	4.44	4.95	5.96	6.46	0.51	0.54	0.65	0.74	1.54	1.84	2.45	2.89	0.98	1.18	1.67	2.04	1	1	1	1

Table 6 Total geometric mean and fuzzy weights of GHRM criteria

GHRM	Geometric mean				Fuzzy weight				Absolute weight
C1	0.442	0.473	0.544	0.591	0.067	0.078	0.105	0.124	0.094
C2	1.665	1.840	2.159	2.320	0.253	0.302	0.417	0.487	0.365
C3	0.662	0.686	0.791	0.855	0.101	0.113	0.153	0.179	0.137
C4	0.771	0.843	1.004	1.063	0.117	0.139	0.194	0.223	0.168
C5	1.226	1.341	1.585	1.746	0.186	0.220	0.306	0.366	0.271

Step 5: *calculate the total fuzzy weights of the sub-criteria*: the weights of the GHRM sub-criteria are calculated based on Eq. (5), shown in Table 7.

The results of Table 7 show that "the development of a specific training program in environmental management" is the main criterion of the GHRM. Moreover, "the employment of applicants with knowledge and awareness of environmental issues" is the least essential criterion among the identified criteria.

Step 6: *the defuzzification and normalization of the fuzzy weights*: the defuzzified values of the weights of criteria and sub-criteria affecting the implementation of the GHRM were determined using Eq. (6). The results of this step are shown in Table 6 for criteria and Table 7 for sub-criteria.

Phase 3: determine the relationship between criteria using the type-2 fuzzy DEMATEL technique.

Step 7: *create an initial direct-relation matrix (A)*: after obtaining crisp weights of criteria and sub-criteria, a questionnaire related to the effect of each criterion on the others was prepared and distributed among experts. After collecting experts' opinions, the verbal data were converted into fuzzy numbers of the type-2 trapezoids (Table 4). Then, the main direct relation matrix was created using Eq. (7). Table 8 shows the initial direct-relation matrix of the GHRM criteria.

Step 8: *the normalization of the initial direct-relation matrix (D)*: the normalized direct relation matrix is obtained using Eqs. (8) and (9). The normalized initial direct-relation matrix of the criteria affecting the GHRM is shown in Table 9.

Step 9: *construct the Z matrix*: the Z matrix derived from the D matrix is constructed according to the membership functions using Eq. (10). There will be eight matrices Z; for example, the matrix Z_a is given as follows:

$$Z_a = \begin{bmatrix} 0 & 0.11 & 0.12 & 0.08 & 0.09 \\ 0.10 & 0 & 0.11 & 0.09 & 0.22 \\ 0.04 & 0.22 & 0 & 0.11 & 0.11 \\ 0.23 & 0.24 & 0.22 & 0 & 0.18 \\ 0.23 & 0.11 & 0.22 & 0.14 & 0 \end{bmatrix} \tag{18}$$

Step 10: *explain the total relation matrix (T)*: Eq. (11) obtains the total relation matrix. The total relation matrix for the successful implementation of the GHRM is shown

Table 7 The normalized weights of sub-criteria

GHRM	Sub-criteria	Fuzzy weight of sub-criteria				Total fuzzy weight				Absolute total weight
C1	C11	0.000	0.000	0.001	0.003	0.000	0.000	0.000	0.000	0.0001
	C12	0.000	0.000	0.001	0.003	0.000	0.000	0.000	0.000	0.0002
	C13	0.000	0.000	0.002	0.006	0.000	0.000	0.000	0.001	0.0003
	C14	0.000	0.001	0.005	0.014	0.000	0.000	0.001	0.002	0.0007
C2	C21	0.051	0.128	0.632	1.421	0.013	0.039	0.263	0.692	0.2686
	C22	0.029	0.076	0.408	0.960	0.007	0.023	0.170	0.467	0.1790
	C23	0.020	0.046	0.226	0.530	0.005	0.014	0.094	0.258	0.0995
	C24	0.018	0.043	0.221	0.532	0.004	0.013	0.092	0.259	0.0990
C3	C31	0.001	0.002	0.012	0.028	0.000	0.000	0.002	0.005	0.0019
	C32	0.001	0.001	0.007	0.017	0.000	0.000	0.001	0.003	0.0012
	C33	0.000	0.001	0.004	0.011	0.000	0.000	0.001	0.002	0.0008
	C34	0.000	0.001	0.005	0.012	0.000	0.000	0.001	0.002	0.0008
C4	C41	0.003	0.006	0.029	0.080	0.000	0.001	0.006	0.018	0.0067
	C42	0.003	0.008	0.040	0.099	0.000	0.001	0.008	0.022	0.0084
	C43	0.003	0.006	0.035	0.092	0.000	0.001	0.007	0.020	0.0077
	C44	0.001	0.004	0.020	0.056	0.000	0.001	0.004	0.012	0.0047
C5	C51	0.012	0.026	0.128	0.324	0.002	0.006	0.039	0.119	0.0449
	C52	0.025	0.052	0.261	0.667	0.005	0.012	0.080	0.244	0.0924
	C53	0.009	0.024	0.129	0.319	0.002	0.005	0.039	0.117	0.0441
	C54	0.007	0.016	0.093	0.241	0.001	0.004	0.028	0.088	0.0330

Table 8 The initial direct-relation matrix of criteria

C5	C4	C3	C2	C1	
((0/27,0/37,0/37,0/45; 1,1), (0/31,0/37,0/37,0/40; 0.9,0.9))	((0/23,0/33,0/33,0/42; 1,1), (0/28,0/33,0/33,0/37; 0.9,0.9))	((0/37,0/47,0/47,0/57; 1,1), (0/42,0/47,0/47,0/52; 0.9,0.9))	((0/33,0/43,0/43,0/50; 1,1), (0/37,0/43,0/43,0/45; 0.9,0.9))	((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	C1
((0/67,0/77,0/77,0/87; 1,1), (0/72,0/77,0/77,0/82; 0.9,0.9))	((0/27,0/37,0/37,0/47; 1,1), (0/32,0/37,0/37,0/42; 0.9,0.9))	((0/33,0/43,0/43,0/53; 1,1), (0/38,0/43,0/43,0/48; 0.9,0.9))	((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	((0/30,0/40,0/40,0/47; 1,1), (0/33,0/40,0/40,0/42; 0.9,0.9))	C2
((0/33,0/43,0/43,0/53; 1,1), (0/38,0/43,0/43,0/48; 0.9,0.9))	((0/33,0/43,0/43,0/53; 1,1), (0/38,0/43,0/43,0/48; 0.9,0.9))	((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	((0/67,0/77,0/77,0/87; 1,1), (0/72,0/77,0/77,0/82; 0.9,0.9))	((0/13,0/23,0/23,0/27; 1,1), (0/15,0/23,0/23,0/22; 0.9,0.9))	C3
((0/57,0/67,0/67,0/77; 1,1), (0/62,0/67,0/67,0/72; 0.9,0.9))	((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	((0/67,0/77,0/77,0/87; 1,1), (0/72,0/77,0/77,0/82; 0.9,0.9))	((0/73,0/83,0/83,0/93; 1,1), (0/78,0/83,0/83,0/88; 0.9,0.9))	((0/70,0/80,0/80,0/90; 1,1), (0/75,0/80,0/80,0/85; 0.9,0.9))	C4
((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	((0/43,0/53,0/53,0/63; 1,1), (0/48,0/53,0/53,0/58; 0.9,0.9))	((0/67,0/77,0/77,0/87; 1,1), (0/72,0/77,0/77,0/82; 0.9,0.9))	((0/33,0/43,0/43,0/53; 1,1), (0/38,0/43,0/43,0/48; 0.9,0.9))	((0/70,0/80,0/80,0/90; 1,1), (0/75,0/80,0/80,0/85; 0.9,0.9))	C5

Table 9 The normalized direct-relation matrix of criteria

C5	C4	C3	C2	C1	
((0/09,0/12,0/12,0/15; 1,1), (0/10,0/12,0/12,0/13; 0.9,0.9))	((0/08,0/11,0/11,0/14; 1,1), (0/09,0/11,0/11,0/12; 0.9,0.9))	((0/12,0/15,0/15,0/18; 1,1), (0/14,0/15,0/15,0/17; 0.9,0.9))	((0/11,0/14,0/14,0/16; 1,1), (0/11,0/12,0/12,0/13; 0.9,0.9))	((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	C1
((0/22,0/25,0/25,0/28; 1,1), (0/23,0/25,0/25,0/26; 0.9,0.9))	((0/09,0/12,0/12,0/15; 1,1), (0/10,0/12,0/12,0/14; 0.9,0.9))	((0/11,0/14,0/14,0/17; 1,1), (0/12,0/14,0/14,0/16; 0.9,0.9))	((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	((0/10,0/13,0/13,0/15; 1,1), (0/10,0/11,0/11,0/12; 0.9,0.9))	C2
((0/11,0/14,0/14,0/17; 1,1), (0/12,0/14,0/14,0/16; 0.9,0.9))	((0/11,0/14,0/14,0/17; 1,1), (0/12,0/14,0/14,0/16; 0.9,0.9))	((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	((0/22,0/25,0/25,0/28; 1,1), (0/23,0/25,0/25,0/26; 0.9,0.9))	((0/04,0/08,0/08,0/09; 1,1), (0/05,0/08,0/08,0/07; 0.9,0.9))	C3
((0/18,0/22,0/22,0/25; 1,1), (0/20,0/22,0/22,0/23; 0.9,0.9))	((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	((0/22,0/25,0/25,0/28; 1,1), (0/23,0/25,0/25,0/26; 0.9,0.9))	((0/24,0/27,0/27,0/30; 1,1), (0/25,0/27,0/27,0/29; 0.9,0.9))	((0/23,0/26,0/26,0/29; 1,1), (0/24,0/26,0/26,0/28; 0.9,0.9))	C4
((0,0,0,0; 1,1), (0,0,0,0; 0/9,0/9))	((0/14,0/17,0/17,0/21; 1,1), (0/16,0/17,0/17,0/19; 0.9,0.9))	((0/22,0/25,0/25,0/28; 1,1), (0/23,0/25,0/25,0/26; 0.9,0.9))	((0/11,0/14,0/14,0/17; 1,1), (0/12,0/14,0/14,0/16; 0.9,0.9))	((0/23,0/26,0/26,0/29; 1,1), (0/24,0/26,0/26,0/28; 0.9,0.9))	C5

in Table 10. Based on the above relation, the total relation matrix is determined in a 5 × 5 matrix.

Step 11: *causal relation analysis*: the total value of rows and columns was calculated for the causal relation analysis. The results are shown in Table 11.

Step 12: *calculate the crisp values of E(W)*: using Eqs. (15) and (16), the crisp values of $D_i + R_i$ and $D_i - R_i$ weights are obtained, which are shown in Table 11.
Step 13: *Combine the fuzzy weights and E(W):* Using Eq. (17), the new crisp values $D + R$ and $D - R$ are obtained (Table 12).

Step 14: *draw a causal diagram*: the dimensional chart of factors affecting the success of the GHRM implementation in the Bushehr Petrochemical Industry is shown in Fig. 3. It should be noted that the causes (influential criteria) are marked with a square, and effects (affected criteria) are marked with a circle.

Conclusion

Studies on sustainable development show that there has been a great deal of interest in sustainability among researchers over the past two decades. One of the main areas of sustainability has been HR sustainability. By taking a closer look, one of the fundamental areas of sustainable HRM is green human resource management or GHRM. In this regard, the present study proposed various criteria and sub-criteria in this field and tried to identify and analyze these criteria and sub-criteria systematically.

The relationship between HRM and environmental management is not yet widely developed in all HRM processes. Various interpretations of GHRM have been proposed, and the most comprehensive of which is proposed by Anwar et al. (2020). They defined GHRM as the awareness and application of environmental components in all HRM processes, such as recruitment, training, rewarding, and developing a green workforce who understand environmentally friendly values and practices. In this regard, this study aimed to establish a link between GHRM processes, identify, and rank the criteria and sub-criteria affecting the successful implementation of the GHRM and the causal relationships between GHRM processes, using fuzzy AHP and type-2 fuzzy DEMATEL techniques. After obtaining the weights of criteria and sub-criteria using fuzzy AHP, the weights were multiplied by $D + R$ and $D - R$ weights obtained by type-2 fuzzy DEMATEL to check whether each criterion or sub-criterion was cause or effect. Based on this approach, the influential factors in the successful

Table 10 The total relation matrix of GHRM criteria

C5	C4	C3	C2	C1	
((0/20,0/38,0/38,0/77; 1,1), (0/27,0/37,0/37,0/51; 0.9,0.9))	((0/16,0/31,0/31,0/65; 1,1), (0/21,0/31,0/31,0/42; 0.9,0.9))	((0/23,0/42,0/42,0/84; 1,1), (0/31,0/42,0/42,0/56; 0.9,0.9))	((0/23,0/42,0/42,0/83; 1,1), (0/30,0/42,0/42,0/55; 0.9,0.9))	((0/11,0/27,0/27,0/61; 1,1), (0/16,0/27,0/27,0/37; 0.9,0.9))	C1
((0/34,0/54,0/54,1/00; 1,1), (0/42,0/54,0/54,0/70; 0.9,0.9))	((0/20,0/37,0/37,0/77; 1,1), (0/27,0/37,0/37,0/51; 0.9,0.9))	((0/27,0/49,0/49,0/97; 1,1), (0/36,0/49,0/49,0/65; 0.9,0.9))	((0/17,0/36,0/36,0/82; 1,1), (0/24,0/36,0/36,0/51; 0.9,0.9))	((0/25,0/45,0/45,0/87; 1,1), (0/32,0/45,0/45,0/58; 0.9,0.9))	C2
((0/25,0/45,0/45,0/89; 1,1), (0/33,0/45,0/45,0/60; 0.9,0.9))	((0/21,0/37,0/37,0/75; 1,1), (0/27,0/37,0/37,0/50; 0.9,0.9))	((0/14,0/34,0/34,0/78; 1,1), (0/23,0/34,0/34,0/49; 0.9,0.9))	((0/35,0/55,0/55,1/01; 1,1), (0/42,0/55,0/55,0/71; 0.9,0.9))	((0/19,0/39,0/39,0/79; 1,1), (0/25,0/39,0/39,0/50; 0.9,0.9))	C3
((0/40,0/66,0/66,1/25; 1,1), (0/50,0/66,0/66,0/87; 0.9,0.9))	((0/18,0/38,0/38,0/86; 1,1), (0/25,0/38,0/38,0/54; 0.9,0.9))	((0/44,0/71,0/71,1/33; 1,1), (0/55,0/71,0/71,0/93; 0.9,0.9))	((0/46,0/74,0/74,1/35; 1,1), (0/57,0/74,0/74,0/95; 0.9,0.9))	((0/42,0/68,0/68,1/23; 1,1), (0/51,0/68,0/68,0/86; 0.9,0.9))	C4
((0/19,0/40,0/40,0/91; 1,1), (0/27,0/40,0/40,0/57; 0.9,0.9))	((0/27,0/46,0/46,0/91; 1,1), (0/34,0/46,0/46,0/62; 0.9,0.9))	((0/40,0/64,0/64,1/19; 1,1), (0/49,0/64,0/64,0/83; 0.9,0.9))	((0/32,0/57,0/57,1/12; 1,1), (0/41,0/57,0/57,0/76; 0.9,0.9))	((0/38,0/61,0/61,1/10; 1,1), (0/46,0/61,0/61,0/76; 0.9,0.9))	C5

Table 11 $D_i + R_i$ and $D_i - R_i$ for GHRM criteria

$D-R$	$D+R$	$E(D_i - R_i)$	$E(D_i + R_i)$	GHRM
-0.566	4.256	((-0/41,-0/58,-0/58,-0/90; 1,1), (-0/46,-0/58,-0/58,-0/66; 0.9,0.9))	((2/29,4/20,4/20,8/30; 1,1), (2/96,4/20,4/20,5/49; 0.9,0.9))	C1
2.688	4.950	((1/53,2/64,2/64,5/13; 1,1), (1/94,2/64,2/64,3/47; 0.9,0.9))	((2/76,4/85,4/85,9/56; 1,1), (3/54,4/85,4/85,6/43; 0.9,0.9))	C2
-0.507	4.815	((-0/35,-0/49,-0/49,-0/89; 1,1), (-0/42,-0/49,-0/49,-0/66; 0.9,0.9))	((2/66,4/71,4/71,9/34; 1,1), (3/43,4/71,4/71,6/27; 0.9,0.9))	C3
1.263	5.178	((0/90,1/26,1/26,2/09; 1,1), (1/04,1/26,1/26,1/55; 0.9,0.9))	((2/91,5/07,5/07,9/97; 1,1), (3/73,5/07,5/07,6/73; 0.9,0.9))	C4
0.235	5.227	((0/17,0/23,0/23,0/40; 1,1), (0/19,0/23,0/23,0/29; 0.9,0.9))	((2/94,5/12,5/12,10/05; 1,1), (3/77,5/12,5/12,6/79; 0.9,0.9))	C5

Table 12 New $D + R$ and $D - R$ for GHRM criteria

New $D-R$	New $D+R$	GHRM
-0.053	0.399	C1
0.982	1.809	C2
-0.069	0.658	C3
0.213	0.872	C4
0.064	1.414	C5

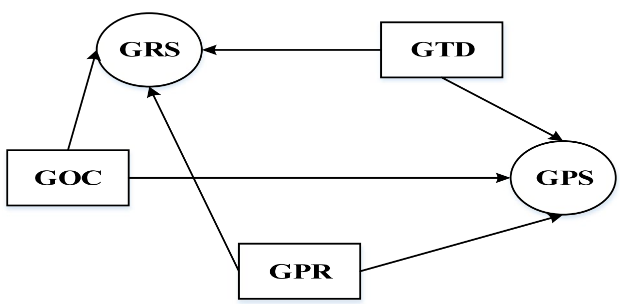

Fig. 3 The cause and effect relations of GHRM criteria

implementation of the GHRM can be divided into two categories. Criteria with positive $D-R$ values are influential factors/causes, and factors with negative $D-R$ values are dependent factors/effects.

According to the results obtained from type-2 fuzzy DEMATEL, it can be stated that "green training and development" (GTD), "green pay and reward system" (GPR), and "green management of organizational culture" (GOC) are influential or causal criteria due to the positive $D-R$. "Green recruitment and selection" (GRS) and "green performance management system" (GPS) are affected or dependent criteria because of negative $D-R$.

As a suggestion for further research in this significant and emerging field, since GHRM establishes a positive attitude and commitment in employees and managers to stop environmental degradation and damage, researchers are recommended to identify the factors influencing the implementation of the GHRM in different industries, rank them with other decision-making methods, and compare them with the results of this study.

Implication and suggestions

Various researches have pointed to different actions and processes of human resource management such as green recruitment and employment, green education and development, green performance evaluation, and compensation for green services and green organizational culture (Zaid et al., 2018; Kim et al., 2019; Anwar et al., 2020; Marrucci et al., 2021; Sharma et al., 2021; Haldorai et al., 2022). However, it should be noted that in the field of green human resource management research, little attention has been paid to the process of managing green organizational culture. Most of these studies have examined the relationships between different green human resource management practices with other environmental, behavioral, psychological, and organizational variables (Anwar et al., 2020; Paillé et al., 2020; Sharma et al., 2021; Darvishmotevali & Altinay, 2022). However, little research has been done on the importance of organizational culture in performing environmental behaviors of employees or on the priority of human resource experts in the green approach of the organization. Therefore, the findings of the present study indicate the high importance and priority of organizational culture management for the implementation of green human resource management in petrochemical companies. In addition, although much research has been done on other green HR practices, however, given the global concern in this area, there is still a great need for research in this area. Also, considering that the process of training and development of green human resources has the highest priority and importance for petrochemical industry experts, it is necessary that education and environmental awareness be systematically considered in petrochemical companies. Just like when employees are trained to do their job properly, they should also learn to behave in an environmentally friendly manner (Renwick et al., 2013; Nisar et al., 2021). Also, several studies have confirmed that in order to successfully implement green human resource management, there must be an alignment between green HR actions (Renwick et al., 2013; Tang et al., 2018; Pham et al., 2020; Muisyo & Qin, 2021). Therefore, managers of petrochemical companies should pay special attention to the various environmental criteria and the link between green human resource management measures. The present study provides interesting management concepts and practical perspectives for organizations concerned with greenery and offers specifically for petrochemical companies. There is a variety of environmental management systems that can help an organization increase environmental sustainability and green the organization's processes or even at another level of the workforce, but it is very costly to implement, and most organizations may not be able to implement it (Sharma et al., 2021).

Hence, other methods such as senior management support for green activities and behaviors (Gupta, 2018; Haldorai et al., 2022), emphasis on the organization's vision and missions on environmental issues (Paillé et al., 2020; Darvishmotevali & Altinay, 2022), and changing employees' attitudes toward the environment by increasing their commitment to avoid non-green behavior (Gupta, 2018; Paillé et al., 2020; Sharma et al., 2021) that emphasize the soft aspect of the organization, i.e., green organizational culture, can help the organization achieve environmental sustainability or increase the organization's green performance. Therefore, considering the mentioned cases, the findings of the present study are in line with the results of previous researches. This study also has valuable findings for senior management and the academic community. Findings show that human resource managers of petrochemical companies to achieve organizational sustainability through green selection and employment, green education, and development can provide a good infrastructure to achieve a high level of environmental performance, and at another level, they can also use from green performance evaluation systems and its connection and horizontal relationship with the service compensation system and reward to employees with higher green initiatives, consider green rewards, and thus create enthusiasm, commitment, and environmental concern in employees. Senior executives of petrochemical companies can create green opportunities by involving employees in green planning, utilizing their tacit knowledge, and empowering employees to play key roles in green leadership. Senior managers must finalize the core values and beliefs about the green issue and environmental issues in their organization, which is a clear example of green organizational culture management. Organizations that create the right culture to support environmental issues will be the most sustainable organizations in terms of greenery in the future, and if the culture is not favorable, this will fail (Muisyo & Qin, 2021; Nisar et al., 2021). Our research findings show that creating an environmentally friendly culture will have a significant impact on the implementation of green human resource management.

When employees are adequately trained to implement environmental measures, they are more motivated to voluntarily participate in the organization's environmental endeavors beyond their assigned job responsibilities (Anwar et al., 2020). Moreover, green training and development improves employees' understanding of the environmental impact of organizational green programs, enhances staff skills in waste reduction, and increases environmental literacy (Paillé et al., 2020). As a result, it is suggested that senior managers and HR executives of the Bushehr Petrochemical Company develop green training and development programs, equip employees with the necessary skills for environmental management, and increase their willingness to participate in environmental activities in the workplace.

Renwick et al. (2013), in their study on the GHRM, concluded that paying and rewarding employees for green activities combined with green training and employee empowerment is essential to achieve the overall goals of environmental management (Gupta, 2018). Therefore, under the findings of the present study, in which service compensation and green reward are influential factors, it is suggested the Bushehr Petrochemical Company's executives consider various forms of rewarding and compensating incentive services, including loans for buying hybrid vehicles, discount cards for green purchases, and appreciation meetings to promote their employees' motivation to work more in green goals. These rewards and incentives, in turn, increase employees' willingness to take the initiative and constructive actions in environmental management.

In this study, another influential criterion is the green management of organizational culture, which is typically managers' and employees' beliefs on environmental issues. In an organization with such a culture, its managers strive to provide the resources needed to assist employees in performing environmental activities (Lamm et al., 2015). Organizational culture management and green support for employees is the organizational support to provide sufficient resources to help employees promote environmentally friendly behaviors and also increase their commitment in this area (Paillé et al., 2020). Therefore, the managers of petrochemical companies are suggested to institutionalize the greenness culture in their organization by their green actions and behaviors and support their employees' green behaviors. To establish a green organizational culture, the organization's managers can take some measures, including creating formal and informal communication channels to spread the green culture, senior managers' support for green initiatives and emphasizing the organization's missions on environmental issues.

Author contribution Ebrahim Rajabpour: ideas, conceptualization, data curation, methodology, and writing. Mohammad Reza Fathi: supervision, formal analysis, investigation, and resources. Mohsen Torabi: investigation, methodology, data curation, and writing—review and editing.

Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval Not applicable.

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