Green human resource management practices: scale development and validity

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Previous studies on green human resource management (GHRM) are mainly positioned at theoretical or qualitative level. There is urgent need to develop a valid measurement of GHRM and then to offer more insights into the implication of it on individual or organizational performance. The aim of this study was to propose and validate an instrument to measure GHRM. Based on exploratory analysis (study 1), it was established that GHRM includes five dimensions: green recruitment and selection, green training, green performance management, green pay and reward, and green involvement. Confirmatory factor analysis (study 2) was used to confirm the factor structure of study 1. The results indicated that the proposed measurement is valid. This study is the first and also the most comprehensive one to measure main human resource practices for environmental management, which can provide broader focus for further research and for practitioners.

> **Key points**
> 1 This study developed a theoretically grounded and empirically validated instrument to measure GHRM.
> 2 We proved that GHRM includes five dimensions: green recruitment and selection, green training, green performance management, green pay and reward, and green involvement.
> 3 The dimensions and items identified in our study can help firms create GHRM policy.

Sustainability is now a worldwide issue, and firms increasingly care about the effect of environmental issues on their competitiveness and long-term success (Paillé et al. 2014). It has been argued that human resources are central in achieving successful

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environmental management (e.g. Daily and Huang 2001; Jackson et al. 2011). From the resource-based viewpoint, human resources are important factors in firms' competitive advantage, due to their rarity, value, non-repeatability, and exclusiveness (Barney 1991; Wright, Dunford and Snell 2001). In the context of environmental protection, human resource management (HRM) can facilitate the successful formulation and implementation of environmental management (Daily and Huang 2001) by aligning practices such as selection, performance evaluation, and training with environmental objectives (Jabbour et al. 2013). Thus, there is an increasing need to integrate green concepts into HRM, referred to as green human resource management (GHRM; Mishra, Sarkar and Kiranmai 2014).

GHRM reflects the HRM aspects of environmental management (Renwick, Redman and Maguire 2013), and its focus is on the role of HRM in pollution prevention through the operational processes of firms (Renwick, Redman and Maguire 2013). The concept of GHRM may include other HRM practices, such as practices related to strategic, high-performance, and high-commitment HRM, but GHRM is different from these constructs in the following several ways.

First, GHRM reflects a firm's orientation toward environmental protection and includes a series of specific HRM practices (Mishra, Sarkar and Kiranmai 2014), which focus on the fragility of ecosystems and the ecological effects of companies' economic activities (Boiral 2002). Other concepts of HRM, such as strategic HRM that relies on organizational strategic goals, have ignored the natural environment, (Delery and Doty 1996). High-performance HRM is a combination of single practices that collectively affect organizational performance, such as the provision of job security and extensive skills training (Sun, Aryee and Law 2007). High-commitment HRM refers to a series of practices that affect performance by creating an organizational commitment environment that stimulates employees' behavior and capabilities, to increase a firm's competitive advantage (Collins and Smith 2006).

Second, except for improvements to organizational performance or internal production processes, GHRM may be more directly beneficial to external stakeholders, while general HRM practices mainly focus on improving organizational performance or profit. GHRM can encourage employees' commitment and involvement in environmental practices, which can increase their sense of belongingness and pride, motivating them to work harder. These environmentally friendly practices can therefore help a firm develop a good reputation , reduce the pressure from stakeholders, and benefit future generations in the long run.

Given its importance and its differences from general HRM, GHRM, its antecedents and consequences have increasingly become the subject of research (e.g. Jackson et al. 2011; Renwick, Redman and Maguire 2013). Some empirical research on GHRM has been carried out (e.g. Paillé et al. 2014), but most recent works have measured GHRM based on qualitative analysis using company declarations, or on empirical analysis by simply combining traditional HRM with environmental management (e.g. Paillé et al. 2014). One weakness is that these studies have failed to adequately address the needs of decision-

makers in organizations, as their findings have not clearly defined a set of successful GHRM practices within an organization (Fernandez, Junquera and Ordiz 2003; Jabbour, Santos and Nagano 2008). Firms need indicators that will help them to determine their level of achievement in GHRM practices. Thus, the aims of this study are 1) to identify a measurement scale for GHRM, and 2) to validate the scale empirically.

In the following sections, we first present a conceptual review of GHRM and identify its structural dimensions. The design of the study and the validation of measures are then reported separately, followed by a discussion of the findings and a review of their implications and extensions. Finally, we present our conclusions.

Green human resource management

It has been proposed that GHRM can be measured by considering its multidimensional nature (e.g. Renwick, Redman and Maguire 2013). For example, Jabbour, Santos and Nagano (2008) argued that improvement in environmental performance depends on making full use of training, teamwork, appraising environmental goals, non-financial rewards, and organizational cultures. Studies that consider GHRM's multidimensional nature take into account its diverse related dimensions. For example, Milliman and Clair (1996) proposed that GHRM should include environmental vision, training, evaluating employees' environmental performance, and providing reward programs. Renwick, Redman and Maguire (2013) suggested that selecting, recruiting, training, and developing environmental knowledge can be considered as the constituents of GHRM.

Despite the diversity of these views, most studies consider that GHRM practices include recruitment and selection, training, performance management, pay and reward systems, and involvement (e.g. Jabbour, Santos and Nagano 2010; Jackson et al. 2011; Renwick, Redman and Maguire 2013; Zibbaras and Coan 2015). We compared the definition and characteristics of five practices from traditional HRM and from GHRM in Table 1.

Green recruitment and selection

Organizations can attract and choose candidates who will commit to environmental issues (Jabbour, Santos and Nagano 2008). Green recruitment and selection (GRS) has been viewed as an important component in GHRM practices (e.g. Ahmand 2015; Jackson et al. 2011) Based on previous studies (e.g. Renwick, Redman and Maguire 2013), we summarize GRS in the three aspects of candidates' green awareness, green employer branding, and green criteria to attract candidates.

First, candidates' green awareness is the basic aspect of GRS, and involves personality factors that enable organizational environmental goals to be achieved, such as green consciousness, conscientiousness, and the agreeableness of candidates. Employees who are of environmental value have been found to actively enhance their environmental knowledge in the operational process, which in turn enhances the environmental performance of their firms (e.g. del Brio, Fernandez and Junquera 2007). Firms should therefore attract

Table 1 Definitions and characteristics of five dimensions in environmental context

HRM practices	Definitions and main processes in HRM	Environmental application
Recruitment and selection (e.g. Jabbour, Santos and Nagano 2010)	The process in organization to hunt and stimulate potential candidates to apply for vacancies, which aims at increasing the quantity of candidates and in turn, reducing this number through various tests to select the best candidate meeting the vacancy	The preference of organization is to select candidates committed and sensitive to environmental issue and willing to contribution to this through internal or external recruitment
Training (e.g. Ivancevich 1992)	A series of learning activities, such as skills, knowledge, provided by organization guides the employees' behaviors towards organizational objectives	Organization implements a system of learning practices related to environmental issues in order to improve employees' aware and skills for environmental management in job
Performance management (e.g. Jabbour, Santos and Nagano 2008)	Aiming at general improvement of employees' performance, organization will compare employees' results with goals, through which the strategic goals would be achieved in the long-term	With the vision of environmental management, organization will appraise employees' environmental results in the whole process of operation to judge their contribution to organizational goals
Pay and reward system (e.g. Jabbour, Santos and Nagano 2010)	A series of rewarding measures aim at attracting, retaining and motivating the most fitting employees, in turn, to encourage relative knowledge, attitudes and behaviors of members to complete organizational objectives	Financial and non-financial rewards for organizational members whose attitude or behavior is conductive to environmental management
Employee involvement (e.g. Renwick, Redman and Maguire 2013)	Employees participate in the operational process and commit to the success of firms, contributing their various capacities to organizational improvement	An opportunity is provided for employees to engage in environmental management. The broad types include participation, support culture and tacit knowledge, which aim at stimulating member's commitment to the environmental management of organization

and select candidates with green awareness using a series of tests, to ensure that all employees are positive about environmental issues (Milkovich and Boudreau 2000).

Second, green employer branding refers to a company's image and reputation related to environmental management, which can be formed through GHRM practices (Ehnert 2009). Willness and Jones (2013) indicated that job-seekers can perceive a good fit between their own and an organization's values through green employer branding, and they may feel a sense of pride working for a company with a good environmental reputation. Job-seekers tend to take information about an organization's environmental performance and description as criteria to judge how organizations treat their employees. Job-seekers can also be attracted to organizations with positive green signals (Jabbour 2011). From this viewpoint, therefore, green branding by employers is an effective method of attracting and selecting potential employees who are positive about environmental issues and images.

Third, employees should be evaluated and selected based on green criteria. For example, recruiting firms can emphasize environmental aspects in job descriptions and employee specifications. Questions related to environmental knowledge, values, and beliefs can be asked (Renwick, Redman and Maguire 2013).

Green training

Green training (GT) refers to a system of activities that motivate employees to learn environment protection skills and pay attention to environmental issues, which is key in accomplishing environmental objectives (Jabbour 2011). Training can increase employees' awareness, knowledge, and skills in environmental activities (Fernandez, Junquera and Ordiz 2003). Green training should be provided along with education programs to all members of the company, not only those linked with environmental departments. In this study, we consider green training to include three aspects: awareness enhancement, knowledge management, and climate building.

First, GT can enhance employees' awareness of pro-environmental activities in the workplace. Green training programs can help employees understand more about the importance of environmental protection, which makes them more sensitive to environmental control and/or prevention processes, such as collecting data on waste and identifying pollution sources (Wong 1998).

Second, GT provides knowledge management that enables employees to carry out environmental activities (del Brio, Fernandez and Junquera 2007). A report revealed that environmental knowledge and values in China are drivers of employees' environmental actions. Through green knowledge management, employees can receive extensive green training, enhancing their knowledge of and skills in environmental protection and improving their abilities in dealing with complex environmental-management (EM) problems (Govindarajulu and Daily 2004). For example, through training, employees can gain knowledge of how to collect data on waste and increase their environmental expertise (Roy and Thérin 2008).

Third, GT builds a climate that encourages all employees to become involved in environmental initiatives (Fernandez, Junquera and Ordiz 2003). Renwick, Redman and Maguire (2013) suggested that integrated training not only includes comprehensive programs but also links them to appraisals and performance management systems, which is a method of creating an environmental work climate.

Green performance management

Green performance management (GPM) refers to a system of evaluating activities of employees' performance in the process of environmental management (Jabbour, Santos and Nagano 2008). Research has focused on specific aspects of GPM, such as delivering feedback and balancing metrics (Jackson et al. 2011; Zibbaras and Coan 2015). It has also been argued that these methods of measuring GPM are not effective, as different firms have different structural attributes, and resources that use uniform standards across firms will be arbitrary (Marcus and Fremeth 2009). Firms need to identify a systematic method of implementing GPM. Adopting a common GPM standard is therefore a priority for several types of firms. In this study, we collected GPM activities using a generic and systematic view and summarized them into four aspects: setting green targets for all members, creating green performance indicators, evaluating employees' green outcomes, and using dis-benefits (Milliman and Clair 1996; Renwick, Redman and Maguire 2013).

Setting green targets for all members emphasizes translating environmental objectives into action plans for all staff (Milliman and Clair 1996). Creating green performance indicators mean establishing a series of green criteria for all members in performance appraisals, covering topics such as environmental incidents, environmental responsibilities, reduction of carbon emissions, and communicating of environmental concerns and policies. Ahmand (2015) claimed that for both managers and employees, the most important aspect of GPM is performance appraisals, which will affect the process and effectiveness of subsequent rewards and compensation. Clear green performance indicators are therefore indispensable in performance management systems. Evaluating managers' green outcomes emphasizes their role in environmental management, which can lead them to be more responsible for EM performance. It is necessary to identify green outcomes and encourage managers to be accountable for EM performance. Dis-benefit is a negative measure to deal with green performance outcomes of members who do not meet EM indicators, or is not compliant with green goals (Renwick, Redman and Maguire 2013). Using these negative measures appropriately may push employees to behave more environmentally and strive for green goals in their future work.

Green pay and reward

In line with a strategic approach to reward management, green pay and reward (GPR) is a system of financial and non-financial rewards, aiming at attracting, retaining, and motivating employees to contribute to environmental goals (Jabbour et al. 2013; Mandip 2012). It has been argued that employees may feel more motivated by non-financial rewards through GPR, such as recognition and praise (Jabbour, Santos and Nagano 2008; Jackson

et al. 2011). Jackson and Seo (2010) suggested that incentives and rewards may be more powerful measures of aligning employees' performance with the firm's goals than other practices in the HRM system. However, generally most researchers acknowledge that combining monetary and non-monetary rewards is more effective in motivating employees (Jabbour, Santos and Nagano 2008; Renwick, Redman and Maguire 2013). In this study, we suggest that non-financial rewards should be offered alongside financial incentives, in the form of green travel benefits, green tax, and green recognition.

First, green travel benefits include rewards for employees' transport and travel. They can be guided to reduce their carbon footprints and have greater awareness of environmental protection. Second, green tax incentives include exemptions to promote the use of bicycles and a less-polluting car fleet. Financial incentives such as these have been introduced by UK companies, and have a major effect on employees' willingness to protect the environment. Third, green recognition entails a system of non-financial rewards for employees, such as company-wide public recognition, paid vacations, and gift certificates. Ramus (2001) claimed that these green recognition rewards lead to feelings of pride among colleagues and more effectively encourage eco-initiatives.

Green involvement

Employees can be provided with opportunities to participate in environmental management, which stimulates them to support the prevention of pollution and identify environmental opportunities (Renwick, Redman and Maguire 2013). A great deal of research has shown that members' green involvement (GI) is crucial in improving the performance of EM systems, such as reducing waste and pollution in workplaces, and making full use of resources (Florida and Davison 2001). Renwick, Redman and Maguire (2013) highlighted a number of processes of employee GI from an integrated perspective. In line with Renwick, Redman and Maguire (2013), we identified five aspects for measuring GI: clear green vision, a green learning climate, various communication channels, offering green practices, and encouraging green involvement.

Clear green vision refers to a system of values and symbols that support environmental management and guides employees to engage in environmental issues (Harris and Crane 2002; Renwick, Redman and Maguire 2013). A green learning climate and the various communication channels enable employees to be well informed about environmental issues in their workplace. A mutual learning climate encourages employees to be concerned about each other's green behavior and awareness. This can create an atmosphere of supervision among employees and enhance their awareness of environmental issues. Several formal or informal communication channels among employees can spread green culture, and also provide a comfortable context in which they can improve their green behaviors and awareness. Employees can be motivated to participate in environmental management by offering green activities, such as writing newsletters, developing problem-solving groups, or setting up green teams. Encouraging GI involves providing employees with opportunities to engage in quality improvement and problem-solving on

environmental issues in the production process, which is an effective way of motivating them to become involved in environmental management.

In summary, firms must identify a way of making the best of human resources to achieve environmental goals. Although the five practices of GHRM have been proposed in much of the literature, the measurement of them still requires empirical validation. Therefore, the development and validation of GHRM scale is the prerequisite for further research in this field.

Method

We have proposed and validated a measurement instrument that can provide a clear understanding and analysis of GHRM practices. To confirm the correspondence between the definition of GHRM and the operational procedure used to measure it (Schwab 1980), we conducted two independent studies. Following Gerbing and Hamilton (1996), we performed exploratory factor analysis (EFA) based on one sample and confirmatory factor analysis (CFA) based on another.

Data collection

We collected our data in the Chinese context in both studies. As the world's largest developing country, China is facing more serious environmental pollution problems than other countries (Paillé et al. 2014). Chinese firms are the driving force of economic development, and take more responsibility than other international firms on protecting the environment. Therefore, the role of Chinese firms in EM should not be ignored.

In study 1, the EFA analysis, a survey was conducted among 153 graduate students enrolled in MBA programs of a university in southwestern China. All students are managers with over 3 years' work experience in their respective companies, and are required to hold a bachelor's degree. These conditions ensured that the participants were acquainted with their firms' operational processes and understood the content of our questionnaire correctly, which was the prerequisite for answering questions on the GHRM practices in their organizations.

We distributed the questionnaires to the students in their MBA classes throughout the day, with the permission of the course instructors. The students were invited to read the general objectives of this study and were given a consent form summarizing the study's ethical guidelines. In addition, we described the concept and characteristics of GHRM to ensure that they have a comprehensive understanding. We excluded 13 participants who told us that as their firms deliver services, they were not involved in EM activities. The MBA instructor allowed the remaining 140 participants to read and complete the questionnaires in a 20-min period, which were then returned to us. We set four reverse questions to recognize the valid questionnaires; one of the reverse items was that 'we haven't made green performance indicators in performance management system and appraisals'. A total of 74 participants returned completed questionnaires, giving a response rate of 52.86%. Table 2 shows the demographic data of our respondents.

Table 2 Demographic information of respondents in study 1

Measure	Items	Frequency	Percentage
Industry type	Manufacturing	15	20.3
	Service	37	50.0
	Others	22	29.7
Firm size (number of employees)	≤99	16	21.6
	100–199	11	14.9
	200–499	5	6.8
	500–999	4	5.4
	≥1000	37	50.0
	Missing	1	1.4
Ownership structure	State owned	34	45.9
	Privately owned	14	18.9
	Foreign owned	12	16.2
	Joint venture	12	16.2
	Missing	2	2.7

$n = 74$.

In study 2, the CFA analysis, we collected data from companies in northern China. With the approval of the CEOs, the human resource department and office directors organized the workers in their enterprise who we then invited to complete the questionnaire. Our researchers explained the specific issues. Completed responses were received from 191 participants and 38 were discarded, either because they were not involved in environmental practices or because they answered the reverse questions incorrectly. The final sample was therefore of 153 participants. The response rate was 80%. Table 3 provides the demographic information of the participants. Missing information was due to either respondents' deliberate omissions or incorrect responses.

Measures
To collect as much relevant information as possible through the literature review, we followed the three criteria proposed by Richards and Gladwin (1999) on collecting relevant issues, indicators, or measures of GHRM. First, entrepreneurs who carry out GHRM practices in the operational process should be recognized in items we selected. Second, the GHRM items should be practical and reliable for firms and their employees. Third, the items should reflect actual HRM practices that affect environmental management and coincide with organizational long-term goals. See the Appendix for a list of 28 HRM and GHRM papers concerned with the practices of HRM or their application in EM.

We identified all relevant HRM or EM practices, submitted this list to two HRM researchers (one professor and one graduate student) and two EM researchers in random order, and provided the researchers with clear definitions of the five dimensions. They were asked to group similar items according to the five original categories of GHRM, and to discuss whether these items accurately reflected the five dimensions. From their

Table 3 Demographic information of respondents in study 2

Measure	Items	Frequency	Percentage
Industry type	Manufacturing	26	17.0
	Service	25	16.3
	Others	21	13.7
	Missing	81	52.9
Firm size (number of employees)	<100	20	13.1
	100–199	9	5.9
	200–499	10	6.5
	500–1000	14	9.2
	>1000	22	14.4
	Missing	78	51.0
Ownership structure	State owned	40	26.1
	Privately owned	8	5.2
	Foreign owned	6	4.0
	Joint venture	5	3.3
	Others	14	9.2
	Missing	80	52.3
Firm's age (years)	1–5	4	2.6
	6–10	6	4.0
	11–15	12	7.8
	16–20	12	7.8
	>20	40	26.1
	Missing	79	51.6

n = 153.

discussion, all but two of the items were retained. The four researchers agreed that green MBA is a part of all training programs, so the training 4 item shown in the Appendix did not need to be retained. All four researchers hesitated to include monetary-based reward in EM. They argued that non-financial rewards may be more useful than financial ones in attracting employees to EM. Egri and Hornal (2002) found through their surveys that most companies offer non-financial instead of financial rewards for employees' contributions to EM. Reward 4 was also found to be part of the broad definition of reward 2. Therefore, training 4 and reward 4 were removed.

The remaining GHRM practices were grouped into 19 measures, and Table 4 describes related constructs with their measurement items.

We developed our questionnaire using these GHRM measures and a 5-point Likert scale ranging from 1 ('completely disagree') to 5 ('completely agree') to measure them. We followed the back-translation technique of Bhalla and Lin (1987) to translate these items into Chinese for the respondents. All measures were professionally translated and back-translated by two PhD students who majored in English and management to ensure conceptual equivalence. We then carried out a pretest with professors in the HRM field to

Table 4   Constructs and their measurement items

Constructs	Proposed measurement items
Green recruitment and selection (GRS)	GHRM1: We attract green job candidates who use green criteria to select organizations
	GHRM2: We use green employer branding to attract green employees
	GHRM3: Our firm recruits employees who have green awareness
Green training(GT)	GHRM4: We develop training programs in environment management to increase environmental awareness, skills and expertise of employees
	GHRM5: We have integrated training to create the emotional involvement of employees in environment management
	GHRM6: We have green knowledge management (link environmental education and knowledge to behaviors to develop preventative solutions)
Green performance management (GPM)	GHRM7: We use green performance indicators in our performance management system and appraisals
	GRHM8: Our firm sets green targets, goals and responsibilities for managers and employees
	GHRM9: In our firm, managers are set objectives on achieving green outcomes included in appraisals
	GHRM10: In our firm, there are dis-benefits in the performance management system for non-compliance or not meeting environment management goals
Green pay and reward (GPR)	GHRM11: We make green benefits (transport/travel) available rather than giving out pre-paid cards to purchase green products
	GHRM12: In our firms, there are financial or tax incentives (bicycle loans, use of less polluting cars)
	GHRM13: Our firm has recognition-based rewards in environment management for staff (public recognition, awards, paid vacations, time off, gift certificates)
Green involvement (GI)	GHRM14: Our company has a clear developmental vision to guide the employees' actions in environment management
	GHRM15: In our firm, there is a mutual learning climate among employees for green behavior and awareness in my company
	GHRM16: In our firm, there are a number of formal or informal communication channels to spread green culture in our company
	GHRM17: In our firm, employees are involved in quality improvement and problem-solving on green issues
	GHRM18: We offer practices for employees to participate in environment management, such as newsletters, suggestion schemes, problem-solving groups, low-carbon champions and green action teams
	GHRM19: Our company emphasizes a culture of environmental protection

refine the measurement items and implemented their feedback to create the final version of the questionnaire.

Data analysis and results

Exploratory factor analysis

Exploratory factor analysis was used to explore the dimensions of the GHRM scale to ensure that all items only loaded onto their respective dimensions. We used the method of principal component analysis with promax rotation, an oblique rotation, based on the assumption that any extracted factors relevant to GHRM should be inter-correlated. We applied two standards to identify the number of factors in the GHRM construct (Hair et al. 2010). Items that had less than a 0.50 loading and cross-loaded on two or more factors at 0.50 or higher were excluded (Roesch and Rowley 2005). We applied an eigenvalue of 1 as the cut-off value for extraction. We removed item GHRM 19 because its cross-loadings on two constructs were higher than 0.50. We identified a 5-factor structure with the extracted factors explaining 77.49% of the total variance. The Kaiser–Meyer–Olkin test yielded a value of 0.80, indicating that the data were suitable for factor analysis. Table 5 summarizes the factor loadings for the condensed 18-item scale. The significant loading of all items on the single factor indicated unidimensionality. No item had multiple cross-loadings on any factor, which supported the preliminary discriminant validity of the scale. The reliability coefficients for all five factors were above 0.70, indicating acceptable reliability.

Confirmatory factor analysis

Mplus 6.11 (Muthén and Muthén 2011) was used to conduct the CFA with the maximum-likelihood method to estimate the parameters. We used several indices to evaluate the goodness-of-fit of a construct: 1) the value of the χ^2 statistic, where $\chi^2/df < 5.0$ (Wheaton et al. 1977); 2) the comparative-fit index (CFI), and the non-normed-fit index (NNFI), which should be >0.90 (Medsker, Williams and Holahan 1994); and 3) the root mean square error of approximation (RMSEA) value should be <0.08 (Browne and Cudeck 1992). We applied specific CFA techniques such as convergent validity, construct reliability, and discriminant validity to confirm the measurement.

First, we examined the convergent validity to verify that all of the proposed measurement items represented the construct itself, following the criteria that all item loadings should be significant and exceed the recommended minimum value of 0.60 (Chin, Gopal and Salisbury 1997). Table 6 shows that all item loadings were >0.60 and all t-values were significant ($p < 0.001$). Therefore, the five constructs met the norms of convergent validity.

Second, we used Cronbach's alpha and composite reliability (Hair et al. 2010) to assess the construct reliability, which represents the internal consistency of the indicators measuring the proposed construct (Fornell and Larcker 1981). The results in Table 6 show that all Cronbach's alpha values and composite reliability were >0.70, which demonstrates the construct reliability of the scales.

Table 5 Exploratory factor analysis for GHRM measures

Constructs	Items	Promax-rotated loading factors				
		1	2	3	4	5
GI	GI1	**.62**	.37	.27	.14	.32
	GI2	**.69**	.26	.37	.10	.23
	GI3	**.71**	.29	.35	.24	.03
	GI4	**.76**	.30	.19	.13	.28
	GI5	**.84**	.16	.08	.12	.08
GPM	GPM1	.31	**.69**	.37	.13	.28
	GPM2	.28	**.73**	.27	.18	.11
	GPM3	.41	**.76**	−.04	.05	.03
	GPM4	.19	**.79**	.40	.20	.16
GT	GT1	.17	.49	**.71**	.21	.08
	GT2	.33	.18	**.75**	.16	.25
	GT3	.27	.18	**.83**	.19	.08
GRS	GRS1	.07	.03	.36	**.78**	.15
	GRS2	.07	.22	.22	**.81**	.09
	GRS3	.28	.11	−.05	**.87**	.04
GPR	GPR1	.10	.10	.19	.27	**.55**
	GPR2	.19	.19	.09	.47	**.61**
	GPR3	.23	−.02	.10	−.03	**.87**
Sum of squares (eigenvalue)		8.80	1.75	1.26	1.09	1.05
Cumulative variance explained (%)		48.91	58.63	65.63	71.68	77.49

Bold values indicate the factor with the highest loading.

Third, we evaluated discriminant validity, which can be inferred when the measure of each construct converges on its true scores. Following Bhattacherjee's (2002) suggestion, we assessed discriminant validity using Chi-square difference tests, in which the χ^2 values of the original model, where any two of the five dimensions correlated freely, are compared with that of the constrained model, where the correlation of the two factors is constrained to 1. Bagozzi, Yi and Phillips (1991) stated that discriminant validity can be demonstrated if the χ^2 values between the original and constrained are significantly different. Table 7 shows that the χ^2 values in the constrained model were significantly larger than those of the non-constrained model, thus confirming that each dimension differed from each of the other dimensions. Discriminant validity was therefore proven.

First-order analysis

Next, we conducted a first-order analysis of GHRM using Mplus 6.11, as shown in Figure 1. Through the first-order model, the five dimensions, GRS, GT, GPM, GPR, and

Table 6 The CFA results for the constructs ($n = 153$)

Dimensions	Items	Standardized loading (λ)	t Value	Cronbach's α	Composite reliability
GRS	GRS1	.75	17.27	.84	.85
	GRS2	.83	23.58		
	GRS3	.83	24.21		
GT	GT1	.77	19.58	.83	.83
	GT2	.78	20.13		
	GT3	.81	23.13		
GPM	GPM1	.82	25.09	.87	.87
	GPM2	.75	18.56		
	GPM3	.73	17.09		
	GPM4	.84	27.43		
GPR	GPR1	.83	25.84	.87	.87
	GPR2	.82	25.10		
	GPR3	.83	26.43		
GI	GI1	.68	14.25	.87	.91
	GI2	.72	16.31		
	GI3	.83	26.62		
	GI4	.78	21.10		
	GI5	.77	20.17		

All item loading were significant at $p < 0.001$. Composite reliability = $(\Sigma\lambda)^2/[(\Sigma\lambda)^2 + \Sigma(1-R^2)]$.

Table 7 Assessment of discriminant validity: χ^2 test

Dimensions	Original model χ^2 (df)	Constrained model χ^2 (df)	χ^2 difference
GRS with GT	15.08 (8)	51.75 (9)	36.67
GRS with GPM	23.31 (13)	61.56 (14)	38.25
GRS with GPR	15.12 (8)	39.99 (9)	24.87
GRS with GI	29.94 (19)	71.89 (20)	41.95
GI with GPR	46.26 (19)	65.57 (20)	19.31
GI with GT	35.73 (19)	61.52 (20)	25.79
GI with GPM	51.32 (26)	76.96 (27)	25.64
GPM with GPR	32.47 (13)	55.01 (14)	22.54
GPM with GT	12.73 (13)	47.13 (14)	34.4
GPR with GT	7.15 (8)	29.18 (9)	22.03

All χ^2 differences were significant at $p < 0.001$.

GI, were confirmed to be independent predictors of the GHRM construct. The results in the first-order model represented the goodness-of-fit of the construct: $\chi^2/df = 1.63$, RMSEA = 0.064, CFI = 0.95 and NNFI = 0.94. In the first-order model, the loading of the first item in every dimension was set to 1.0 to fix the construct variance, and the results were all standardized. The factor loadings for GRS, GT, GPM, GPR, and GI ranged from
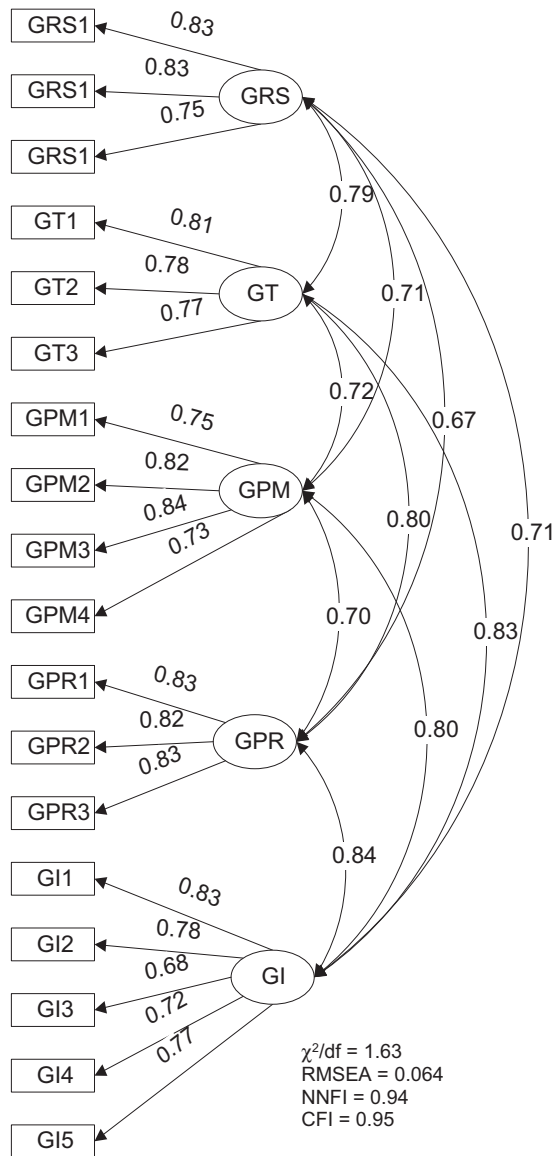
Figure 1 First-order model of GHRM

0.75 to 0.83, 0.77 to 0.81, 0.73 to 0.84, 0.82 to 0.83, and 0.68 to 0.83, respectively. The highest correlation value was 0.84, between GI and GPR, followed by 0.83 between GI and GT, and the others ranged from 0.67 to 0.80. Therefore, the results showed that the correlation values of the five constructs were relatively large, and may have a common higher factor.

Second-order analysis

Based on the results of the first-order analysis, we tested the second-order model of GHRM, also with Mplus 6.11, as shown in Figure 2. In the second-order model, a latent factor was posited to govern the correlations among the five dimensions (Kuo and Hsu 2001). The loading of the first item in every dimension was again set to 1.0 to fix the construct variance and the results were all standardized. The path coefficients from the second-order construct (GHRM) to the five dimensions were all significant and >0.7. All of the goodness-of-fit indices were above the criterion values: χ^2/df = 1.65, RMSEA = 0.065, CFI = 0.95 and NNFI = 0.94. Several goodness-of-fit indices in the second-order model were clearly greater than in the first-order model, such as the value of χ^2/df and RMSEA, which is in line with the view of Doll, Xia and Torkzadeh (1994). A second-order model cannot exhibit better fit values than a first-order model. Therefore, an additional test was necessary to justify GHRM as a second-order construct.

Following Marsh and Hocevar's (1985) suggestion, we used the target (T) coefficient, which is the ratio of the Chi-squares of the first- and second-order models, to measure the efficacy of the second-order construct. The maximum of the T coefficient is 1.0, and the closer to 1.0, the more reasonable the value. As shown in figures 1 and 2, the T coefficient of the first- and second-order models was 0.95, representing a reasonable value. The results demonstrated that the second-order construct (GHRM) could explain the first-order constructs and validly represent the relationships between them. The results also revealed that GI had the highest path coefficient ($r = 0.93$), followed successively by GT ($r = 0.91$), GPR ($r = 0.87$), GPM ($r = 0.83$), and GRS ($r = 0.81$). The final results are extremely intriguing, and agree with the view of GHRM in the literature – that is, the critical aspects of human resource management for the environment may be intangible in the long-term, such as employee involvement (Renwick, Redman and Maguire 2013) and organizational culture (Jabbour and Santos 2008).

Discussion and implications

Recent studies have stated that HRM is necessary in EM (del Brio, Fernandez and Junquera 2007; Paillé et al. 2014). However, there are very limited empirical studies on GHRM as there is no systematic and valid instrument for measuring the concept. Although Renwick, Redman and Maguire (2013) discussed the nature and key contents of GHRM, their suppositions has not been tested. Schwab (1980) also emphasized the necessity of developing a GHRM measurement. We developed a theoretically grounded and empirically validated instrument to measure GHRM, based on previous studies. We proved that GHRM includes five dimensions: GRS, GT, GPM, GPR and GI, which can be represented by 18 items.

Theoretical and practical implications

First, GRS and performance appraisal were examined by Zibarras and Coan from the perspective of employee lifecycles (2015). They stated that candidates with environmental
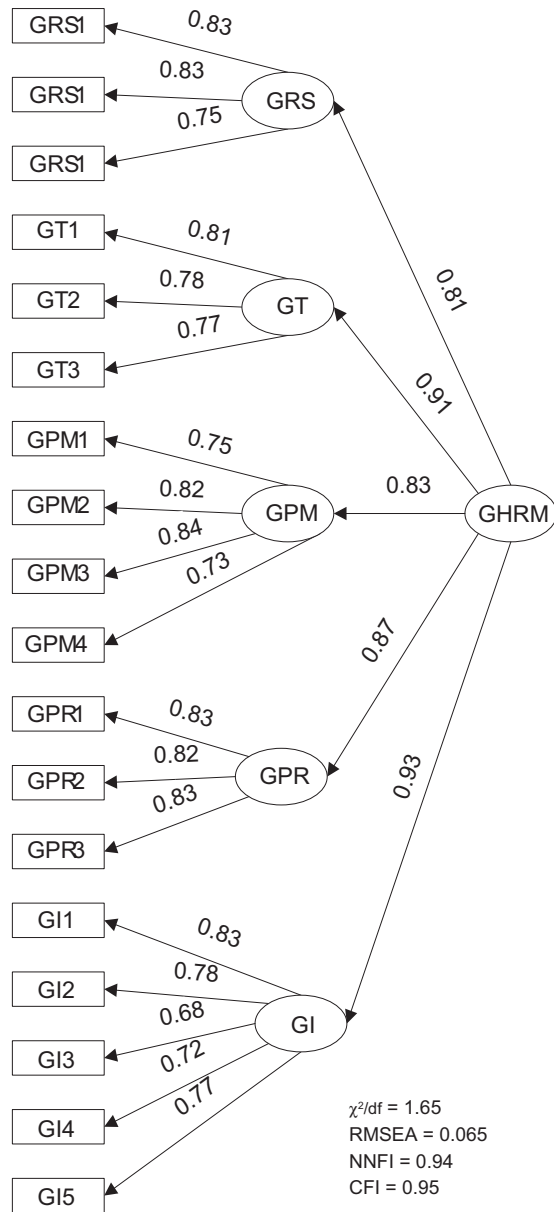
Figure 2 Second-order model of GHRM

awareness should be selected by the company and then evaluated based on the organization's green criteria. It has been suggested that individuals are attracted by an organization's green image in the process of GRS (Behrend, Baker and Thompson 2009).

Companies with an environmental orientation are more likely to hire applicants possessing environmental knowledge and motivation (Guerci, Longoni and Luzzini 2016; Jabbour, Santos and Nagano 2008). Job-seekers also consider an organization's environmental performance as a standard of employee treatment, and they may feel pride in working for an organization with a good green reputation (Willness and Jones 2013).

Second, in line with Zibbaras and Coan (2015), Ahmand (2015) stressed that the crucial aspect of GPM is performance appraisal, which focuses on all members' responsibilities and outcomes in environmental management. It is important for organizations to carry out GPM activities, such as balancing metrics to measure environmental outcomes and determining how to distribute responsibility throughout the whole organization (Jackson et al. 2011). Such activities can guide employees to align their behaviors with environmental objectives and also provide clear information to employees concerning what they should do or not do (Harvey, Williams and Prober 2013).

Third, GT may create a green climate in which employees understand green training and the importance of environmental outcomes (Ramus 2002). GT may include a series of programs, such as energy conservation and waste reduction in the work process, providing opportunities to solve environmental problems. However, Perron, Cote and Duffy (2006) found that training in environmental management may not always be successful. Jackson et al. (2011) suggested that trainee readiness, needs analysis, and employee cynicism may all influence the effectiveness of green training. Therefore, companies should take these barriers into consideration in the process of green training.

Fourth, our study is similar to that of Handgraaf, de Jeude and Appelt (2013), which also indicated that social and recognition rewards were more effective than monetary rewards in GPR. As we pointed out, dis-benefits have a place in performance management systems if environmental management goals are not met, but if negative warnings are too harsh they may discourage employees (Renwick, Redman and Maguire 2013). Similarly, weak rewards would not motivate employees to achieve environmental goals (Jackson et al. 2011).

Last, the results in our second-order model showed that GI (such as employees' participation and environmental vision) were also important dimensions of GHRM, which highlighted the key role of employees (del Brio, Fernandez, and Junquera 2007; Florida and Davison 2001). As Haddockmillar, Sanyal and Müllercamen (2016) stated, employee engagement in green activities is vital to the effective implementation of environmental strategies and one of the significant challenges faced by organizations today. Similarly, many scholars (e.g. Boiral 2002; Jabbour, Santos and Nago 2008) have linked employees' green involvement to efficacy and efficiency of EM processes.

Concerning practical implications, our findings can broaden the horizons of managers in organizations. In the process of environment management, managers should consider all dimensions of GHRM as tested in this study. Managers should hire employees with high environmental value or skills. Such potential employees are more sensitive to environmental issues, would probably demonstrate superior green performance or behavior in the workplace. Evaluating employees' performance by considering their green behavior or

attitude is very important, and has been shown to be associated with superior environmental performance (Guerci, Longoni and Luzzini 2016). Employees should be encouraged to participate in environmental decision-making activities. Their involvement also provides them with the opportunity to make best use of their skills or knowledge to contribute to environmental performance. In all, organizations that either do not have GHRM practices or are just beginning to implement them should create or benchmark GHRM policies using the dimensions and items identified in our study to enhance environmental performance.

Limitations and future directions

This study has several potential limitations that should be addressed in future research. First, we tested the measurements of GHRM on Chinese respondents. This can give us a sufficient understanding of GHRM in a non-western context, but it is also necessary to recognize cross-cultural HRM practices in EM. Connecting the eastern and western contexts in future research would ensure this issue is addressed. Second, we explored several primary practices of GHRM. The items proposed may have been only some of the activities companies use regarding EM. As Renwick, Redman and Maguire (2013) noted, stressing green issues in socialization processes and leadership styles would develop the EM of firms. The level of attention companies pay to GHRM practices also differs, so it would be useful to examine other measurements of GHRM that are not identified in our findings. Third, the current study on measurement and validation of GHRM is at the forefront of empirical research in this field. The development and validation of a GHRM scale is the prerequisite for further research in this field. Our GHRM scale is based on Chinese firms which engage in environmental practices. It is possible that firms which are not targeting environmental excellence may also practice GHRM to improve their employee or organizational performance. A study that tests the scale in that situation would contribute to further insights into the effect of GHRM on individual or organizational performance. Finally, in the data collection process, we removed those firms that were not involved in EM practices on the assumption that firms with EM are more likely to engage in GHRM. The extent to which firms included in the sample practice EM is also critical for firms' GHRM behaviors. Thus, future research could continue to investigate the relationship between EM and GHRM.

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Appendix Literature review on the measurement items of HRM in EM

Dimensions	Codes	Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Training	Training 1	Develop training programs in environment management	*		*		*		*	*	*	*	*	*	*	*	*		*	*	*		*	*	*	*	*	*	*	*
	Training 2	Integrated training to create the emotional involvement of employee	*		*			*		*				*					*				*	*	*			*	*	*
	Training 3	Green knowledge management			*							*								*	*	*	*	*	*				*	*
	Training 4	Green MBAs for managers			*																				*					
Performance	Performance 1	Green performance indicators in performance management system				*			*	*	*	*		*	*		*		*	*	*	*	*	*	*	*	*	*	*	*
	Performance 2	Sets green targets, goals and responsibilities for managers and employees			*		*	*	*	*	*		*	*			*		*				*		*	*	*	*	*	*
	Performance 3	Managers set objectives on achieving green outcomes			*											*		*		*			*		*					
	Performance 4	Dis-benefits					*															*					*			
Pay and reward	Reward 1	Green benefits (transport/travel)			*	*	*			*	*	*		*	*		*					*	*	*	*	*				*
	Reward 2	Financial or tax incentives			*	*	*		*	*			*				*		*	*	*		*	*	*	*			*	*
	Reward 3	Recognition-based reward			*						*						*		*	*					*			*	*	*
	Reward 4	Monetary-based pay			*	*	*				*	*			*		*		*			*						*		
Involvement	Involvement 1	Clear developmental vision in environment management			*		*			*	*	*			*		*		*	*	*	*						*		
	Involvement 2	Mutual learning climate for green behavior							*				*		*		*			*			*							
	Involvement 3	Formal or informal communication channels to spread green culture			*		*			*	*		*				*				*	*								
	Involvement 4	Quality improvement and problem solving on green issues	*			*		*	*	*	*	*		*	*	*	*	*		*	*		*	*	*		*	*	*	*
	Involvement 5	Practices in environment management	*		*	*	*	*	*	*	*	*			*				*	*		*	*	*	*	*	*	*	*	*
	Involvement 6	A culture of environmental protection											*							*					*				*	
Recruitment and selection	Recruit 1	Attract green job candidates															*						*			*	*		*	*
	Recruit 2	Green employer branding				*													*			*	*		*		*		*	*
	Recruit 3	Recruits employees who have green awareness	*									*		*			*			*		*						*	*	*