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Research article

Assessing organizations performance on the basis of GHRM practices using BWM and Fuzzy TOPSIS

Himanshu Gupta

Department of Management Studies, Indian Institute of Technology Roorkee, India

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ABSTRACT

Over the past few years, the need for sustainable environmental management has increased rapidly and green management has emerged as an important tool for the same. The role of Green Human Resource Management (GHRM) practices in environmental management and green management is widely known but still lesser discussed in academic literature. Thus, realizing the importance of GHRM in environmental management by organizations, this study attempts to identify the important practices of GHRM and evaluate the performance of manufacturing organizations using GHRM practices. A three-phase methodology is used for the same. The first phase involves identification of GHRM practices in manufacturing organizations through literature review and expert opinion. The second phase involves ranking of GHRM practices using Best Worst Method (BWM) and third phase methodology involves evaluating manufacturing organizations on the basis of GHRM practices using Fuzzy Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). This research can help managers to identify important practices of GHRM for their organization. This study also provides a framework for managers to evaluate their organization's performance on the basis of GHRM practices.

1. Introduction

Increased manufacturing facilities have caused a transformative change in the economic condition of the developing countries, these changes are greatly influenced by resource constraints and environmental challenges (Marquis et al., 2015; Ren et al., 2017). Also, pressure from stakeholders has forced the modern-day organizations to introduce environment-friendly processes and activities (Molina-Azorín et al., 2009). Organizations commitment towards saving the environment is an indicator of its environmental performance, the performance depends on the following criteria: ability of the organization to control the pollution, lesser discharge of waste in the environment, implementation of recycling and reuse practices at the organization and implementation of systems like ISO 14001 at the organization. All these activities and systems require direct involvement of Human Resource Management (HRM) department (Lober, 1996; del Brío et al. 2007). The success of these pro-environmental strategies is ensured only when they are well aligned with organizations HRM practices (Collins and Clark, 2003). For any new strategy to succeed, organizations require competent manpower and resources that are well trained in performing that task (Jiang et al., 2012). Similarly, implementing green practices in the organization for environmental protection is an arduous task which is largely dependent on the availability of right workforce and managers. Thus, organizations need to develop a strong GHRM department that can recruit people with zeal towards environment protection and also train its current workforce to adopt and implement these activities through proper training programs or by luring them through rewards and special benefits (Mishra, 2017). Ren et al. (2017) have given a working definition of GHRM as “phenomena relevant to understanding relationships between organizational activities that impact the natural environment and the design, evolution, implementation, and influence of HRM systems”.

GHRM although being a very important area for organizations is still less researched and most of the studies are done in western context (Masri and Jaaron, 2017; Ragas et al., 2017; Tang et al., 2017). Almost all of these studies are based on either literature review or are focusing on investigating the relationship between GHRM and some other constructs like organizational performance. No study has been done to rank the practices of GHRM. With the aim to address these gaps, this study has following objectives:

- This study aims to identify practices of GHRM in Indian context through extensive literature review and expert opinion.
- This study aims to rank the practices of GHRM using a novel best – Worst methodology.
- This study aims to rank manufacturing organizations on the basis of

E-mail address: himanshuguptadoms@gmail.com.

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their performance on identified GHRM practices using Fuzzy TOPSIS.

The rest of this study is organized as follows: second section aims to identify GHRM practices through review of past studies and expert opinion. The third section elaborates about the hybrid methodologies used in the study. The fourth section is dedicated to illustrating the application of proposed methodology through a case study of certain organizations. The fifth section discusses results and presents their analysis. The sixth section presents managerial and practical implications. The seventh section is dedicated to sensitivity analysis and the last section gives conclusions and scope of future work.

2. Literature review

GHRM refers to using HRM practices to reinforce environmental sustainable practices and increase employee's commitment on the issues of environmental sustainability. It embraces considering concerns and values of Environmental Management (EM) in applying Human Resources (HR) initiatives generating greater efficiencies and better Environmental Performance (EP) necessary for reducing employees' carbon footprints (Masri and Jaaron, 2017). A detailed review of studies carried out in the field of GHRM taking different perspectives is presented in Table 1.

2.1. Green recruitment and selection

Traditionally recruitment and selection functions of an organization are focused only on selecting a candidate who can fulfill desired job responsibilities and drive performance among a set of candidates (Ramasamy et al., 2017). However, to build and maintain a green workplace the organization needs to select and hire an employee who supports and is interested in the environment (Renwick et al., 2013). Environmental management has taken center stage among an organization's goals and thus they follow a systematic recruitment and selection process which concentrate on green abilities and knowledge of the candidates (Ahmad, 2015). The main attributes of green recruitment and selection (GRS) are: Hiring candidate with environmental knowledge and awareness (Jabbour, 2011; Ahmad, 2015; Masri and Jaaron, 2017; Nejati et al., 2017; Tang et al., 2017); Green branding to attract green employees (Tang et al., 2017); Preferring candidates who choose green criteria to shortlist organizations (Tang et al., 2017); Preferring internal employees with green abilities to fill vacant positions (Nejati et al., 2017); Designing job positions exclusive considering environmental aspects of the organizations (Opatha, 2013; Masri and Jaaron, 2017); Making candidates aware of organizations environmental goals during recruitment process (Mandip, 2012; Renwick et al., 2013); Using online tools like video conferencing for recruitment (Muniandi and Nasruddin, 2015; Masri and Jaaron, 2017).

2.2. Green training and development

Training is necessary skill sets which help employees to improve their knowledge and help them to be innovative (Liebowitz, 2010). However, with growing environmental concerns, the organizations are more inclined towards providing green training to its employees. Green training incites employees to acquire certain skills to attend to the environmental concerns of the organizations and focus on environmental improvements thus meeting the organization's objectives (Jabbour, 2011; Tang et al., 2017). Green training is the most significant method through which HRM can accomplish organizations environmental objectives and help the organization to transit towards a more sustainable organization (Teixeira et al., 2012; Jabbour, 2013). The main attributes of green training and development (GTD) are as follows: Developing exclusive training programs on environmental management for employees (Masri and Jaaron, 2017; Tang et al., 2017); Green knowledge management initiatives (Tang et al., 2017); Providing all the training material online to reduce paper cost (Kapil, 2015; Masri and Jaaron, 2017); Designing special workshops for energy management within the organization (Our contribution); Special training session for waste management and recycling (Renwick et al., 2008, 2013; Jabbour, 2013); Engaging employees in environmental problem solving (Zoogah, 2011); Job rotation in green assignments (Prasad, 2013; Arulrajah et al., 2016).

2.3. Green performance management system

It pertains to a system of appraising employees' performance in environmental management abilities (Jabbour et al., 2008). HR managers use green work rating as an indicator for evaluating employees job performance related to environment and thus help promote environmental objectives of the organization by monitoring and evaluating employees behavior and performance (Kapil, 2015; Sharma and Gupta, 2015). Traditional performance management systems left out on sustainability aspect of the organization and focused only on objectives like the ability to maximize profit, but keeping into consideration future needs, green performance management specifically concentrates on organizations and employees ability to accomplish green and sustainability objectives (Tapamoy, 2008; Ramasamy et al., 2017). The main attributes of green performance management system (GPS) are as follows: Using green performance indicators during appraisals (Kapil, 2015; Sharma and Gupta, 2015; Tang et al., 2017); Setting green objectives and targets for employees (Masri and Jaaron, 2017; Nejati et al., 2017; Tang et al., 2017); Setting objectives for managers for green outcomes from employees (Renwick et al., 2013; Prasad, 2013; Masri and Jaaron, 2017; Tang et al., 2017); Negative appraisal for noncompliance with environmental objectives (Renwick et al., 2008; Nejati et al., 2017; Tang et al., 2017); Employee assessments after attending Green Training (GT) (Nejati et al., 2017); Regular feedback to employees to achieve environmental goals (Jackson and Seo, 2010; Jackson et al., 2011; Arulrajah et al., 2016; Nejati et al., 2017);

2.4. Green Pay and Reward System

Green pay and reward (GPR) system are means of inciting employees to work towards environmental objectives of the organization through financial and non-financial rewards. It is also an attempt to prevent talented employees to leave the organization and also attract new employees having knowledge of green practices (Jabbour et al., 2008; Mandip, 2012). Modern organizations adopt the practice of strategically rewarding the employees who work towards achieving organizations environmental objectives (Ahmad, 2015; Ramasamy et al., 2017). Continuously appreciating the employees and rewarding them for their eco-initiatives keep them motivated and aligned towards environmental practices (Daily and Huang, 2001; Renwick et al., 2013). The main attributes of GPR are as follows: Green travel benefits to the employees (Ramus, 2001; Jackson et al., 2011; Renwick et al., 2013; Jabbar and Abid, 2014; Tang et al., 2017); Financial incentives and tax cuts (Ramus, 2001; Jabbour et al., 2008; Arulrajah et al., 2016; Kapil, 2015; Tang et al., 2017); Green recognition for environmental management (Ramus, 2001; Masri and Jaaron, 2017; Nejati et al., 2017; Tang et al., 2017); Bonus pay for employees surpassing their environmental targets (Nejati et al., 2017); Rewards for innovative environmental suggestion (Prasad, 2013; Ahmad, 2015; Masri and Jaaron, 2017);

2.5. Green Employee Empowerment and Involvement

Green employee empowerment and involvement (GEI) refers to a system where employees are given opportunities to take part in environmental management initiatives and thus making them an integral part of various practices to prevent pollution and waste management

Table 1
Past studies related to GHRM.

Author	Summary/Key findings	Country/Region	Methodology/Tool Used
Renwick et al. (2008)	They developed a model for GHRM to demonstrate the relationship between HRM and green performance. Their research has two-way implications, on one hand, they are of the view that organizations green abilities influence HRM activities to be more successful.	Generic	Literature Review
Jabbour et al. (2010)	This study investigates the role of HRM in the environmental management of the organizations. The results found that HRM influences environmental management throughout its implementation stages.	Brazil	Correlation, Factor analysis, Case study
Jabbour et al. (2013a,b)	The authors in their study tried to investigate the environmental management on the operational performance of automotive firms through the integration of HR and lean management practices. The results found that HR practices positively impact environmental management of the organizations.	Brazil	Structural Equation Modeling (SEM)
Renwick et al. (2013)	They conducted a literature review mainly to integrate the literature of environment management with HRM. They used Ability-Motivation-Opportunity theory to categorize existing literature. The findings suggest that organizations are not adopting all GHRM practices and are lagging on knowledge of certain practices.	Generic	Literature Review
Zibarras and Coan (2015)	The study was conducted to assess whether the HR practices influence pro-environmental behavior of organizations or not. The results indicate that management commitment can influence pro-environmental behavior but still organizations in the UK are found to be lacking in implementing HRM practices for environmental management.	United Kingdom (UK)	Pearson Chi-square test
Gholami et al. (2016)	They conducted a study to check the influence of GHRM in enhancing the sustainability of sports centers. Through factor analysis, 7 factors were identified and performance management", and "player involvement and empowerment" were found most important factors for implementation of the whole system.	Malaysia	Factor analysis, Interpretive Structural Modeling (ISM), SEM
Guerci et al. (2016)	They tested the mediating role of various GHRM practices between stakeholders (customer and government) with the organizational performance. The results confirm the importance of GHRM practices in improving the environmental performance of the organization.	Italy	Partial Least Square (PLS) -SEM
Jabbour and Jabbour (2016)	They conducted a study to propose a framework for integration of GHRM practices with Green Supply Chain Management (GSCM) practices. They are of the view that integration of GHRM with GSCM is essential for attaining sustainability.	Generic	Conceptual Study
Longoni et al. (2016)	They tried to study the deployment of environmental management initiatives across various functions in the organization. They studied the impact of adopting GHRM and GSCM on environmental and financial performance. The results indicate that GHRM and GSCM jointly exert a positive impact on the performance of the organization and also GSCM act as a mediator between GHRM and firms' performance.	Italy	Regression Analysis
Pinzone et al. (2016)	They carried out a study to investigate the role of GHRM in healthcare. They studied the role of mediating role of collective affective commitment to Environmental Management (EM) between green competencies, green performance management & green employee involvement with collective organizational behavior towards the environment. They conclude that GHRM is conducive to the collective behavior of employees towards EM and also employees' willingness and involvement in EM mediates the above relationship.	England	Path analysis
Shen et al. (2016)	They conducted a study to explore the relationship between employees GHRM perceptions and their non-green work outcomes. Perceived organizational support has been used as moderator and organizational identification is used as a mediator. Results indicate that GHRM positively influences work outcome of non-green employees.	Australia	SEM, Exploratory Factor Analysis (EFA)
Tariq et al. (2016)	They conducted a systematic literature review regarding GHRM and studied the role of employee empowerment as a mediator for employees' motivational levels for carrying on green activities. A total of 104 articles were reviewed and they concluded that empowered employees are more motivated to perform environmental tasks which pay to be green.	Generic	Literature Review
Yong and Mohd-Yusoff (2016)	Their major aim was to investigate the role of Strategic Human Resource Management (SHRM) practices in the implementation of GHRM in organizations. The HR competencies are considered important for implementing GHRM more specifically strategic positioner or manager is found to influence GHRM adoption.	Malaysia	Regression analysis, *t*-test
Masri and Jaaron (2017)	They conducted a study to assess the impact of GHRM practices on Environmental Performance (EP) of Palestinian manufacturing companies. A total of 17 HR managers were interviewed and 6 main GHRM practices were identified. A total of 110 manufacturing organizations were involved and results indicated that all the 6 GHRM practices have a positive impact on EP of the manufacturing organizations.	Palestinian	Analysis of Variance (ANOVA) and correlation analysis
Mishra (2017)	The study aimed to investigate the status of GHRM in Indian manufacturing industries and what are the challenges faced by them. Top management support and interaction among departments for learning is essential for GHRM. A framework for the holistic sustainable development of organizations through GHRM is provided.	India	Mixed method study
Nejati et al. (2017)	The study was conducted on 161 manufacturing firms to investigate the impact of GHRM practices on GSCM and also see the moderating effect of employees' resistance to both. "Green development and training", "Green employee empowerment" and "Green pay and rewards" emerged as most important factors for GHRM. Resistance to change is also found to effect GHRM adoption.	Iran	PLS-SEM
Ragas et al. (2017)	They carried out a research to study the moderating role of green lifestyle to effect of GHRM on the job performance of employees. A total of 332 respondents were taken up for study and results indicated that GHRM implementation has an impact on employees lifestyle and hence their job performance.	Philippines	SEM, EFA

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Table 1 (*continued*)

Author	Summary/Key findings	Country/Region	Methodology/Tool Used
Ren et al. (2017)	They conducted a literature review of past studies on GHRM and developed a model of the antecedents, consequences, and contingencies related to GHRM. The model encompasses of external environmental factors and internal environment factors for GHRM.	Generic	Literature Review
Tang et al. (2017)	They carried out a study to develop a comprehensive scale for measuring GHRM practices. Based on their study they concluded that GHRM consists of five dimensions.	China	Confirmatory Factor Analysis (CFA)
Ullah (2017)	The study identified certain GHRM practices viz. green HR planning, green recruitment, green induction, green training and development, green performance appraisal, green learning & development, green compensation & reward management and green employee relations.	Generic	Literature Review
Yusliza et al. (2017)	The study was conducted on manufacturing and service organizations of Malaysia to assess the role of eHRM, green employee empowerment, and HR business partner role on GHRM adoption. Green employee empowerment emerged as almost important enabler for GHRM.	Malaysia	PLS-SEM

(Renwick et al., 2013; Tang et al., 2017). Involving employees in different capacities in decision making inculcate a sense of ownership in them and help align organizations environmental objectives with that of employees' individual goals and capabilities (Lashley, 2012; Ramasamy et al., 2017). The main attributes of GEI are as follows: Clear developmental policies and vision for environmental management (Nejati et al., 2017; Tang et al., 2017); Climate for mutual learning about green practices among employees (Tang et al., 2017); Employee involvement in problem solving on green issues (Liebowitz, 2010; Tang et al., 2017); Practice sessions and workshops for participation in environmental management (Masri and Jaaron, 2017; Tang et al., 2017); Setting up system for employees environmental management schemes (Masri and Jaaron, 2017; Nejati et al., 2017); No punishment for unsuccessful environment improvement ideas (Nejati et al., 2017); Introducing green whistle-blowing and help-lines (Masri and Jaaron, 2017); Involving employees for formulating green strategy and decision making (Margaretha and Saragih, 2013; Masri and Jaaron, 2017).

2.6. Green Management of Organizational Culture

"An organization's environmental culture consists of the set of assumptions, values, symbols, and organizational artifacts that reflect the desire or necessity of being an environmentally correct organization" (Harris and Crane, 2002). Green culture and commitment towards organization are fundamental tools for achieving sustainability goals of the organization (Mokhtar et al., 2016; Ramasamy et al., 2017). Understanding and adopting green culture can help organization to ascertain that employees are committed towards green initiatives and goals of the organization (Ramasamy et al., 2017). The various attributes of Green Management of Organizational Culture (GOC) are as follows: Setting formal and informal communication channels to spread green culture (Tang et al., 2017); Support from top management for green practices (Ramus and Steger, 2000; Daily and Huang, 2001; Johnson and Walck, 2004; Masri and Jaaron, 2017); Organizations mission includes environmental concerns (Paillé, and Mejía-Morelos, 2014; Masri and Jaaron, 2017); Departmental budgets covering environmental impact (Masri and Jaaron, 2017); Green themed games (Ragas et al., 2017); Improving employee health and safety (O'Donohue and Torugsa, 2016).

After extensive literature review and series of discussion with experts using Delphi technique, a total of thirty-nine attributes of GHRM are finalized which are further categorized into six main attribute categories. The detail of the finalized attributes is presented in Table 2.

2.7. Research gaps and highlights

Asian countries are increasingly confronting to the growing environmental degradation caused due to rapid industrialization and growing number of industries and their employees (Marquis et al., 2015). As these disruptions are caused by large human interventions, so there is need to explore human involvement in various activities and find out measures to improve human involvement in various activities impacting the environment (Davis and Challenger, 2013). With the growing awareness regarding environmental management, the organizations are bringing up the concept of GHRM for effective environmental management (Ren et al., 2017). Organizations policies and strategies towards environmental management will fare well only when they are in sync with human resource practices of the organization (Collins and Clark, 2003). GHRM is one such concept that can align organizations environmental strategies with efficient workforce by either training them or recruit workforce according to environmental policies (Renwick et al., 2013). But studies related to GHRM are at the very nascent stage and still limited to a few countries like Europe (Zibarras and Coan, 2015), Malaysia (Gholami et al., 2016; Yong and Mohd-Yusoff, 2016); Australia (Shen et al., 2016). There are almost negligible studies on GHRM in Indian context (Mishra, 2017). India being adversely affected by environmental degradation is an important country to study about GHRM practices, World Bank report shows that India has 13 top polluted cities of the world out of 20. Thus the need to study GHRM practices in the context of developing nations like India is essential. Also, most of the past studies have identified few GHRM practices and there is no study providing a comprehensive list of GHRM practices. This study presents a list of thirty-nine GHRM practices categorized into six main categories; the comprehensive list can act as a basis for future research. Further, most of the studies have either investigated the effect of GHRM on employee performance and resistance (Ragas et al., 2017; Nejati et al., 2017); additionally some have carried out literature review or scale development process for GHRM practices (Ren et al., 2017; Tang et al., 2017). This is the first study to investigate the performance of organizations on the basis of GHRM practices. Lastly, there is no study to rank and prioritize the GHRM practices, this is the first initiative to rank the GHRM practices so that HR managers of other organizations can work on improving those practices to achieve the overall goal of environmental management.

3. Methodology

To rank GHRM practices and evaluate the performance of manufacturing organizations, a three-phase methodology is proposed (Fig. 1).

Phase 1 involves identification of experts, literature review and discussion with experts through Delphi method to finalize practices of GHRM. Delphi method involves several rounds of discussion with experts until a final consensus is reached between experts. Total of five experts from five different organizations were selected. One HR expert from each organization is taken for conducting the whole study. Expert 1 is a Senior Manager- Recruitment for a leading automobile company; he looks after recruitment of new staff and talent acquisition. He is

Table 2
Finalized attributes of GHRM.

Main attribute	Sub-attributes	Brief explanation	References
Green Recruitment and Selection (GRS)	Hiring candidate with environmental knowledge and awareness (GRS1)	This refers to selecting the right candidate having green awareness through the use of certain tests related to environmental issues	Milkovich and Boudreau, 2000; Jabbour, 2011; Ahmad, 2015; Shen et al., 2016; Masri and Jaaron, 2017; Nejati et al., 2017; Tang et al., 2017
	Green branding to attract green employees (GRS2)	This deals with building organizations green image through adoption of various environmental practices	Ehnert 2009; Kapil, 2015; Longoni et al., 2016; Tang et al., 2017
	Preferring candidates who choose green criteria to shortlist organizations (GRS3)	This refers to preferring those candidates who select organization on the basis of green criteria and organizations green performance so that a good fit can be obtained between organizations and employees goals	Renwick et al., 2013; Willness and Jones, 2013; Tang et al., 2017
	Preferring internal employees with green abilities to fill vacant positions (GRS4)	Organization give preference to its internal employees with green acumen to fill the vacant position	Renwick et al., 2013; Nejati et al., 2017
	Designing job positions exclusively considering environmental aspects of the organizations (GRS5)	This deals with creating positions in an organization specifically for managing green practices of an organization like an environmental manager, energy expert etc.	Opatha, 2013; Masri and Jaaron, 2017
	Making candidates aware of organizations environmental goals during recruitment process (GRS6)	This has to do with reflecting organizations environmental aspects, green achievements and future sustainable goals and requirements to the candidate during interview	Mandip, 2012; Renwick et al., 2013; Arulrajah et al., 2016; Longoni et al., 2016
	Using online tools like video conferencing for recruitment (GRS7)	This refers to minimizing the trend of in-person interview and promoting the online tools like video conferencing to reduce traveling cost and fuel wastage	Muniandi and Nasruddin, 2015; Masri and Jaaron, 2017
Green Training and Development (GTD)	Developing exclusive training programs on environmental management for employees (GTD1)	This deals with designing and developing specialized training programs according to the needs of the organization like training on recycling, waste reduction etc.	Mandip, 2012; Longoni et al., 2016; Masri and Jaaron, 2017; Tang et al., 2017
	Green knowledge management initiatives (GTD2)	This refers to the systematic management of organizations knowledge assets using green technologies like the use of data centers and cloud technologies which can help reduce carbon footprint and also help impart green training.	Govindarajulu and Daily, 2004; Botelho, 2012; Renwick et al., 2013; Tang et al., 2017
	Providing all the training material online to reduce paper cost and wastage (GTD3)	This deals with uploading all training material online so that employees have easy access to it and use of paper for printing training documents is minimized	Kapil, 2015; Masri and Jaaron, 2017; Ullah, 2017
	Designing special workshops for energy management within the organization (GTD4)	This refers to training employees about the importance of energy saving and methods to minimize energy wastage like switching off the electric equipment before leaving through special workshops	Our contribution
	Special training session for waste management and recycling (GTD5)	This has to do with training employees about waste management techniques like better designing of products and change in production methods to reduce material use or new packaging methods, checking for any reusable or recyclable product before disposing of that product etc.	Renwick et al., 2008, 2013; Jabbour, 2013; Tung et al., 2014
	Job rotation in green assignments (GTD6)	This has to do with rotating job of employees of the organization to various departments and roles where green practices are being followed so as to train them in various job roles. Also, it comprises of transferring employees who are not working on green practices to green focus areas so to accustom them to green practices being followed.	Prasad, 2013; Arulrajah et al., 2016
	Engaging employees in environmental problem solving (GTD7)	This refers to involving employees from all level to solve problems related to environmental management and take their viewpoints also.	Zoogah, 2011; Longoni et al., 2016
Green Performance Management System (GPS)	Using green performance indicators during appraisals (GPS1)	This deals with establishing certain green criteria like performance in green incidents, green responsibilities, carbon emission reduction, waste reduction etc. for appraisals.	Renwick et al., 2013; Kapil, 2015; Sharma and Gupta, 2015; Tang et al., 2017
	Setting green objectives and targets for employees (GPS2)	This has to do with setting green targets at the start of each year for employees like each employee can be given a target of 10% waste reduction or reduction in energy cost.	Longoni et al., 2016; Masri and Jaaron, 2017; Nejati et al., 2017; Tang et al., 2017
	Setting objectives for managers for green outcomes from employees (GPS3)	This refers to setting targets for managers to extract certain green related outcomes from employees. Like supply chain managers can be asked to reduce logistics related fuel and energy consumption of his group of employees.	Prasad, 2013; Renwick et al., 2013; Longoni et al., 2016; Masri and Jaaron, 2017; Tang et al., 2017
	Negative appraisal for noncompliance with environmental objectives (GPS4)	This refers to negative appraisal in the form of non-increment or reduction in salary or bonus of employees who fail to achieve environmental objectives set to them.	Renwick et al., 2013; Nejati et al., 2017; Tang et al., 2017
	Employee assessments after attending GT (GPS5)	This deals with assessing the knowledge acquired by employees after attending green training through simple questionnaires or small activities.	Teixeira et al., 2016; Nejati et al., 2017
	Regular feedback to employees to achieve environmental goals (GPS6)	This has to do with providing continuous feedback to employees on their performance in green activities so that they can improve on areas where they are lagging.	Jackson and Seo, 2010; Jackson et al., 2011; Arulrajah et al., 2016; Zibarras and Coan, 2015; Nejati et al., 2017

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Table 2 (*continued*)

Main attribute	Sub-attributes	Brief explanation	References
Green Pay and Reward System (GPR)	Green travel benefits to the employees (GPR1)	This has to do with providing transport facilities and travel benefits to employees who wish to purchase green products.	Ramus, 2001; Jackson et al., 2011; Renwick et al., 2013; Jabbar and Abid, 2014; Tang et al., 2017
Green Employee Empowerment and Involvement (GEI)	Financial incentives and tax cuts (GPR2)	This refers to giving loans to buy bicycles or Euro IV compliance vehicle to help reduce vehicular pollution in the organization.	Ramus, 2001; Jabbour and Santos, 2008; Renwick et al., 2013; Arulrajah et al., 2016; Kapil 2015; Tang et al., 2017
	Green recognition for environmental management (GPR3)	This deals with publically recognizing, rewarding in terms of gifts, vacations, time off etc. to employees who excel in environmental management initiatives.	Ramus, 2001; Masri and Jaaron, 2017; Nejati et al., 2017; Tang et al., 2017
	Bonus pay for employees surpassing their environmental targets (GPR4)	This refers to giving monetary benefits in terms of bonus to employees who surpass their environmental targets.	Longoni et al., 2016; Nejati et al., 2017
	Rewards for innovative environmental suggestion (GPR5)	This has to do with special rewards (both financial and non-financial) to employees who give an innovative green suggestion.	Prasad, 2013; Renwick et al., 2013; Ahmad, 2015; Masri and Jaaron, 2017
	Green team excellence awards (GPR6)	This refers to rewarding teams rather than individual employees that are involved in environmental management.	Bhushan and Mackenzie, 1994; Ullah, 2017
	Clear developmental policies and vision for environmental management (GEI1)	This deals with developing policies that are clear about organizations environmental goals and are properly communicated to each employee. Also, the organization mission statement should reflect environmental goals.	Nejati et al., 2017; Tang et al., 2017
	Climate for mutual learning about green practices among employees (GEI2)	This refers to creating a healthy work culture where employees and work in coordination with employees of other departments and acquire green skills.	Tang et al., 2017
	Employee involvement in problem-solving on green issues (GEI3)	This has to do with involving employees of all level in decision making related to environmental improvement and taking their continuous feedback on various initiatives.	Liebowitz, 2010; Tung et al., 2014; Tang et al., 2017
	Practice sessions and workshops for participation in environmental management (GEI4)	This refers to involving employees in environmental management through their participation in organization newsletters, suggestion schemes and in the form of green teams in events related to environmental management.	Masri and Jaaron, 2017; Tang et al., 2017
	No punishment for unsuccessful environment improvement ideas (GEI5)	This refers to motivating employees to participate in environmental improvements by ignoring any failed suggestions they have given for environmental improvements which even has resulted in loss to the organization.	Nejati et al., 2017
	Introducing green whistle-blowing and help-lines (GEI6)	This has to do with setting a system where employees can report any unethical or illegal activity that is being carried out in an organization that results in environmental degradation through some helplines.	Masri and Jaaron, 2017
	Involving employees in formulating green strategy and decision making (GEI7)	This refers to involving employees while formulating any new strategy to cope environmental degradation.	Margaretha and Saragih, 2013; Masri and Jaaron, 2017
Green Management of Organizational Culture (GOC)	Setting formal and informal communication channels to spread green culture (GOC1)	This deals with developing a culture such that employees and both formally and informally communicate with each other or managers maybe during lunch or tea breaks regarding environmental concerns.	Tang et al., 2017
	Support from top management for green practices (GOC2)	This refers to continuous support from top management to its employees to implement green practices in their area which they feel can improve the environment.	Ramus and Steger, 2000; Daily and Huang, 2001; Johnson and Walck, 2004; Masri and Jaaron, 2017
	Organizations mission includes environmental concerns (GOC3)	This has to do with including various environmental concerns like industrial waste management, sustainable management of raw material, air and water emissions in organizations mission.	Paillé, and Mejía-Morelos, 2014; Masri and Jaaron, 2017
	Departmental budgets covering environmental impact (GOC4)	This deals with allocating a separate budget for each functional department to cater the needs of environmental management and pollution reduction.	Masri and Jaaron, 2017
	Green-themed games (GOC5)	This has to do with the introduction of green-themed games for employees to inculcate the culture of environmental management amongst them.	Ragas et al., 2017
	Improving employee health and safety (GOC6)	This refers to creating a safe environment for workers by following certain environment related rules to avoid any hazard at workplace.	O'Donohue and Torugsa, 2016

having experience of more than twelve years in various manufacturing organizations. Expert 2 is General Manager Learning and Development in a steel manufacturing company. This expert is involved in training and overall development of staff for past more than twenty years and has a team of about fifteen HR professionals working under him. Expert 3 is an Assistant General Manager of staff appraisal and performance

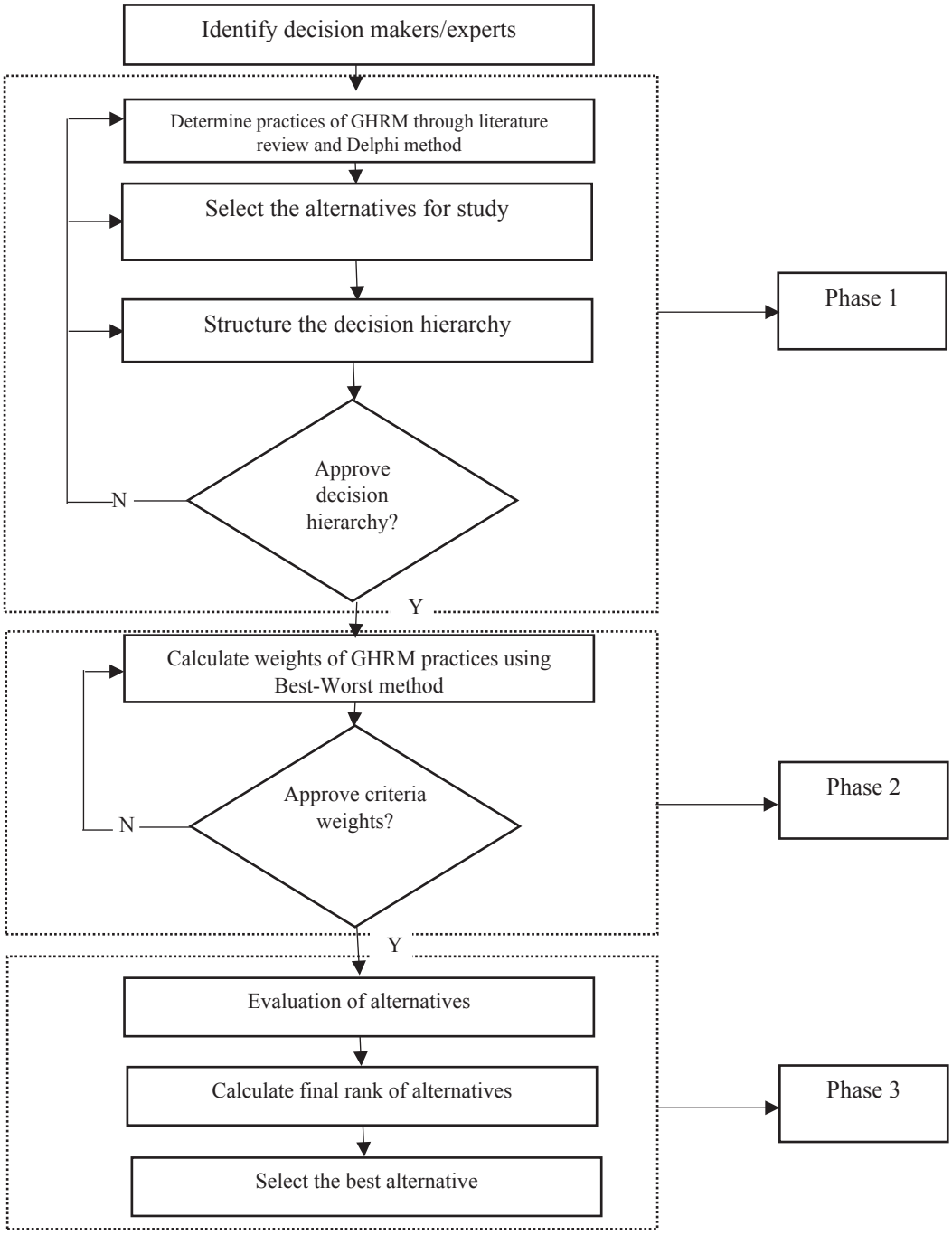

Fig. 1. Schematic diagram for phases of methodology.

management system in a machine manufacturing company. He looks after the yearly appraisal and performance analysis of the employees and has a vast experience of around fifteen years in staff appraisal roles. Expert 4 is Vice president HR of another leading automobile company and is in charge of almost all HR functions which includes recruitment, staffing, appraisals, staff grievances, training etc. He is also a member of the organization's committee working on achieving the green goals of the organization. He has a total twenty-five years of experience in various capacities related to HR functions. Expert 5 is a General Manager Staff recruitment and training for a steel manufacturing company. He looks after both recruitment of new employees as well as training and development of existing employees. He has experience of about twenty years in training and recruitment of employees. Initially, through literature review, forty-two attributes were identified; these attributes were put forth to experts for finalization. After series of discussions with five experts using Delphi technique, four attributes were deleted and one was added thus making it a total of thirty-nine attributes. These were then grouped into six main categories for the purpose

of analysis. The second phase involves ranking of the GHRM practices; BWM given by Rezaei (2015, 2016) is used to rank the barriers. There are several MCMD (Multi Criteria Decision Making) techniques available like AHP (Analytical Hierarchal Processing), ANP (Analytical network Processing), MAUT (Multi Attribute Utility Theory), SMART (Simple Multiple Attribute Rating Technique) etc. to rank the criteria (Subramoniam et al., 2013; Bhattacharya et al., 2014; Mir et al., 2016; Wang et al., 2016, 2017; Scholz et al., 2017), but BWM has advantage over this technique because it requires lesser number of pair-wise comparisons as compared to other MCDM techniques like AHP (Rezaei, 2015). BWM compares the alternatives with best alternatives and worst alternative with all other alternatives only, so relatively lesser data is required than AHP which requires pair-wise comparison among all the alternatives. Also Rezaei et al. (2018) in their paper on airport baggage service quality assessment mentioned that BWM can work well with only 4–10 experts, so this method has other advantage that it requires lesser number of experts for analysis apart from less number of data points. BWM is a very strong MCDM technique and is widely used by researchers all over the world like Gupta and Barua, 2016 (technological innovation enablers ranking); Rezaei et al., 2016 (green supplier selection); Gupta and Barua, 2017 (green supplier selection); Gupta, 2017 (airport evaluation based on service quality); Salimi and Rezaei, 2017 (evaluating firms R&D performance); van de Kaa et al., 2017a (selection of biomass technology); van de Kaa et al., 2017b (selecting electric vehicle); Abadi et al., 2018 (evaluation of medical tourism strategy). In the third phase, manufacturing organizations are ranked using Fuzzy TOPSIS methodology. Fuzzy TOPSIS is the most widely used methodology for conditions like the ranking of alternatives (Kannan et al., 2014; Patil and Kant, 2014; Kabra and Ramesh, 2015; Prakash and Barua, 2015; Gupta and Barua, 2017; Kumar and Dash, 2017). The details of each phase are discussed in further subsections:

3.1. Finalization of the criteria for study

A total of thirty-nine GHRM practices categorized into six main categories finalized using literature review and Delphi method.

3.2. Obtaining weights of GHRM practices using BWM

BWM is used to rank the GHRM practices. The steps as given by Rezaei (2015, 2016) are explained below:

Step 1: Selection of attributes (barriers) for analysis.

Through literature review and expert opinion, the attributes are finalized for analysis.

Step 2: Among finalized attributes best and the worst attribute is finalized by each expert for both main category and subcategory attributes.

Step 3: Next each expert is asked to give preference rating for the best attribute selected over all other attributes using a scale of 1–9.

Step 4: After this, preference rating of all attributes with the worst attribute is taken by experts.

Step 5: Optimized weights ($w_1^*, w_2^*, \ldots \ldots, w_n^*$) for all the attributes is calculated next.

The objective is to obtain the weights of attributes so that the maximum absolute differences for all j can be minimized for $\{|w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W|\}$. This minimax model will be obtained:

$$\min \max \quad \{|w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W|\}$$

$$\text{s.t.} \sum_j w_j = 1$$

$$w_j \geq 0, \quad \text{for all } j \tag{1}$$

Model (1) when transformed into a linear model gives better results, the model is shown below:min ξ^Ls.t.

$$|w_B - a_{Bj}w_j| \leq \xi^L, \ \text{for all } j$$

$$|w_j - a_{jW}w_W| \leq \xi^L, \ \text{for all } j$$

$$\sum_j w_j = 1$$

$$w_j \geq 0, \ \text{for all } j \tag{2}$$

Model (2) can be solved to obtain optimal weights ($w_1^*, w_2^*, \ldots \ldots, w_n^*$) and optimal value ξ^L.

Consistency (ξ^L) of attribute comparisons close to 0 is desired (Rezaei, 2016).

3.3. Ranking the alternatives through Fuzzy TOPSIS

The TOPSIS methodology is well known MCDM technique that was first presented by Hwang and Yoon (1981); Lai et al. (1994). The major advantage of using TOPSIS is the requirement of very fewer data points from experts like criteria weights and linguistic preference of alternatives. TOPSIS methodology works on the principle that we consider we have n criteria and m alternatives and selected alternative is having a minimum distance from positive ideal solution and maximum distance from negative ideal solution. Since TOPSIS requires giving preference ratings to alternatives through experts, but it is often difficult for experts to give precise ratings for alternatives. To overcome this limitation, Fuzzy TOPSIS is suggested where fuzzy numbers are used to give preference rating by experts (Chang et al., 2008; Sun, 2010).

The steps of Fuzzy TOPSIS methodology are presented below:

Step 1: Scale mentioned in Table 3 is used to formulate a pair-wise comparison matrix ($\check{k}_{ij}$) which consists of comparison of alternatives with respect to criteria of study. This study uses linguistic fuzzy scale and follow the rule that triangular fuzzy numbers lie in the range [0,1] thus doing away with the requirement of normalization (Dağdeviren et al., 2009).

Step 2: After obtaining pair-wise comparison matrix this matrix is converted into the weighted normalized matrix as shown below:

$$\check{V} = [\check{v}_{ij}]_{m\times n} \text{where } \ i = 1, 2, 3, \ldots m \text{ and } \ j = 1, 2, 3, \ldots n \text{ and}$$

$$\check{v}_{ij} = \check{k}_{ij} \otimes w_j \tag{3}$$

Step 3: Next FPIS and FNIS are obtained, where FPIS and FNIS is 'fuzzy positive ideal' and the 'fuzzy negative ideal solution' respectively:

$$A^+ = \{v_1^+, \ldots\ldots\ldots, v_n^+\}, \ \text{where } v_j^+ = \{\max(v_{ij}) \text{if } j\varepsilon J; \min(v_{ij}) \text{ if } j\varepsilon J'\}, \quad j = 1\ldots.n \tag{4}$$

$$A^- = \{v_1^-, \ldots\ldots\ldots, v_n^-\}, \quad \text{where } v_j^- = \{\min(v_{ij}) \text{if } j\varepsilon J; \max(v_{ij}) \text{ if } j\varepsilon J'\}, \quad j = 1\ldots.n \tag{5}$$

Step 4: Using equation mentioned below, distance of each solution is obtained from FPIS and FNIS:

$$d_i^+ = \left\{\sum_{j=1}^n (v_{ij} - v_{ij}^+)^2\right\}^{1/2}, \ i = 1\ldots\ldots\ldots m$$

$$d_i^- = \left\{\sum_{j=1}^n (v_{ij} - v_{ij}^-)^2\right\}^{1/2}, \ i = 1\ldots\ldots\ldots m \tag{6}$$

Step 5: Closeness coefficient (CC_i) for each solution is obtained by using the equation below:

$$CC_i = \frac{d_i^-}{d_i^- + d_i^+} \ i = 1\ldots\ldots\ldots m \quad CC_i \varepsilon (0,1) \tag{7}$$

Table 3
Linguistic scale for alternatives selection.

Linguistic Variables	Corresponding Fuzzy Numbers
VL	(0, 0, 0.2)
L	(0, 0.2, 0.4)
M	(0.2, 0.4, 0.6)
H	(0.4, 0.6, 0.8)
VH	(0.6, 0.8, 1)
E	(0.8, 1, 1)

Where VL – "Very Low", L – "Low", M – "Medium", H – "High", VH – "Very High" and E – "Excellent".

Step 6: Finally solutions are ranked on the basis of CCi values obtained.

4. Illustrative application of proposed methodology, results and implications of the study

This section explains the application of three-phase methodology on case companies selected for the study. The methodology is instrumental in presenting a model for selecting best organization on GHRM practices. The real world application of the proposed model is helpful in proving its validity.

4.1. Case companies and experts' background

For the purpose of the analysis, five manufacturing organizations are taken to evaluate their performance in GHRM practices. All the experts were chosen based on the reputation, performance, and number of staff in the organization they are working with and also on the basis of their experience. The organizations having a minimum of 300 employees were selected and HR managers having a minimum of 10 years of experience were selected for the study.

4.2. Finalization of attributes of GHRM

After extensive literature review and series of discussion with experts using Delphi technique, a total of thirty-nine attributes of GHRM are finalized which are further categorized into six main attribute categories. Initially, through literature review, forty-two attributes were identified; these attributes were put forth to experts for finalization. After series of discussions with five experts using Delphi technique, four attributes were deleted and one was added thus making it a total of thirty-nine attributes. These were then grouped into six main categories for the purpose of analysis.

4.3. Calculation of criteria weights using BWM

After the attributes of GHRM are finalized, the weights of these attributes are calculated using steps shown in section 3.2 of the paper. Using panel consensus method, experts were asked to rate the main criteria on a scale of 1–9. The resultant pair-wise matrix for main category attributes of GHRM is shown in Table 4.

Similar to above, the pair-wise comparison matrix for sub-attributes associated with each attribute is obtained through experts' opinion. The corresponding matrices obtained for sub-attributes of GHRM are presented in Tables 5–10 below.

Next, using equations (2) and (3), the weights of main attributes as well as sub-attributes of GHRM are calculated and are presented in Tables 11 and 12.

4.4. Ranking of the selected manufacturing organizations using Fuzzy TOPSIS

Next step in the analysis is the calculation of the rank of the alternatives (manufacturing organizations in this case) w.r.t to GHRM practices. The experts were asked to rate the organizations w.r.t the GHRM practices using linguistic scale mentioned in Table 3. The resultant fuzzy relationship matrix along with sub-attributes weights is mentioned in Table 13.

Next step is to calculate weighted normalized fuzzy matrix as per equation (3) and is presented in Table 14. Also FPIS, A^+ and FNIS, A^-, are determined using equations (4) and (5). FPIS and FNIS in this case can be defined as $v_1^+ = (1,\ 1,\ 1)$ and $v_1^- = (0,\ 0,\ 0)$ respectively, for benefit criteria and as $v_1^+ = (1,\ 1,\ 1)$ and $v_1^- = (0,\ 0,\ 0)$ for cost criteria, but in this case all the attributes are considered benefit because the aim is to maximize the implementation of GHRM practices in organizations, so the values of FPIS and FNIS are taken as per this situation.

Next step is to obtain the closeness coefficient value CC_i and a final ranking of alternatives using equations (6) and (7). The CCi values and ranking of alternatives is shown in Table 15.

4.5. Discussion of the results

The attributes weights of GHRM practices are obtained through BWM and are presented in Tables 11 and 12. Total six main attributes

Table 4
Main attributes comparison matrix.

BO	Green Recruitment and Selection (GRS)	Green Training and Development (GTD)	Green Performance Management System (GPS)	Green Pay and Reward System (GPR)	Green Employee Empowerment and Involvement (GEI)	Green Management of Organizational Culture (GOC)
Best criteria: Green Training and Development (GTD)	6	1	9	4	3	7

OW	Worst criteria: Green Performance Management System (GPS)
Green Recruitment and Selection (GRS)	2
Green Training and Development (GTD)	9
Green Performance Management System (GPS)	1
Green Pay and Reward System (GPR)	3
Green Employee Empowerment and Involvement (GEI)	4
Green Management of Organizational Culture (GOC)	2

Table 5
Pairwise comparison for Green Recruitment and Selection sub attributes.

BO	GRS_1	GRS_2	GRS_3	GRS_4	GRS_5	GRS_6	GRS_7
Best criteria: GRS_1	1	3	9	8	6	5	2

OW	Worst criteria: GRS_3
GRS_1	9
GRS_2	4
GRS_3	1
GRS_4	2
GRS_5	3
GRS_6	2
GRS_7	5

Table 6
Pairwise comparison for Green Training and Development sub attributes.

BO	GTD_1	GTD_2	GTD_3	GTD_4	GTD_5	GTD_6	GTD_7
Best criteria: GTD_1	1	9	8	7	4	2	3

OW	Worst criteria: GRS_3
GTD_1	9
GTD_2	1
GTD_3	2
GTD_4	2
GTD_5	3
GTD_6	5
GTD_7	4

Table 7
Pairwise comparison of Green Performance Management System sub-attributes.

BO	GPS_1	GPS_2	GPS_3	GPS_4	GPS_5	GPS_6
Best criteria: GPS_1	1	2	4	5	8	7

OW	Worst criteria: GPS_5
GPS_1	8
GPS_2	5
GPS_3	3
GPS_4	2
GPS_5	1
GPS_6	2

Table 8
Pairwise comparison of Green Pay and Reward System sub-attributes.

BO	GPR_1	GPR_2	GPR_3	GPR_4	GPR_5	GPR_6
Best criteria: GPR_3	9	6	1	3	4	7

OW	Worst criteria: GPR_1
GPR_1	1
GPR_2	2
GPR_3	9
GPR_4	4
GPR_5	3
GPR_6	2

were finalized and among them, Green Training and Development (GTD) is ranked first with a criteria weight of 0.487. Green training has been considered most important variable for environmental management in organizations (Daily et al., 2012; Jabbour et al., 2013a,b). Technical expertise is seen as prerequisite for implementing environmental management practices in an organization (Jabbour et al., 2015). Moreover, green training also helps managers to acquire green contracts and in green purchasing (Teixeira et al., 2016). The companies tend to become environmentally superior when their green training programs are implemented extensively (Teixeira et al., 2012). The second rank is obtained by Green Employee Empowerment and Involvement (GEI) with criteria weight of 0.173. Organizations adopt horizontal work structure where employees are empowered to take decisions and also express their opinions as and when required (Govindarajulu and Daily, 2004). Moreover, organizations are continuously facing challenges in implementing environmental strategies due to lack of employee involvement in green activities (Haddockmillar et al., 2016). The efficiency of environmental management is directly linked to employees' green involvement and it significantly improves, when employees are party to it (Jabbour et al., 2008). Empowerment along with employee involvement is essential as it allows employees to address environmental issues along with top management (Daily et al., 2012). Empowerment boosts the morale of employees to better participate in environmental issues due to more independence and this results in better problem solving and achieving the environmental targets (Govindarajulu and Daily, 2004; Liebowitz, 2010). Next important attribute of GHRM as per BWM analysis is Green Pay and Reward System (GPR) with a criteria weight of 0.129. Renwick et al. (2013) in their study on GHRM gave an important conclusion that pay and reward to employees performing well on green activities are essential along with green training and employee empowerment in order to achieve overall objectives of environmental management. Various forms of rewards and recognition apart from monetary benefits are being practiced by organizations to motivate their employees for further working on green goals like loans for purchasing hybrid vehicles, green cards for discounts, appreciation during meetings etc. (Govindarajulu and Daily, 2004; Brockett, 2006). These rewards and motivations in turn create a willingness among employees to take environmental initiatives (Ramus, 2001).

Similar to main attributes of GHRM, sub-attributes are also ranked using BWM. Developing exclusive training programs on environmental management for employees (GTD1) is ranked first. Training of employees on EM is essential as these employees are front-line workers they can identify various types of waste thus working towards its reduction. Organizations design and specific training programs for employees to equip them with necessary skills to implement EM practices is also very essential (Longoni et al., 2016; Masri and Jaaron, 2017). Job rotation in green assignments (GTD6) is ranked second among sub-attributes. Organizations in developing countries have not fully adopted green practices in each functional area, there are few departments where green practices are being adopted and as a result, other employees are not well accustomed to green practices. So, it is necessary to rotate employees to departments where green practices are being followed thus enhancing awareness of green practices (Arulrajah et al., 2016). Employee involvement in problem solving on green issues (GEI3) is ranked third among sub-attributes. Employee involvement boosts morale of the employees and they are more aligned with organizations objectives when they are involved in decision making processes (Patel, 2014). Higher employee involvement in green issues enhances the tacit knowledge of the employees and this in turn helps in better problem solving related to environmental issues and better environmental performance of the organization (Rothenberg, 2003; Boiral and Paillé, 2012).

The manufacturing organizations are ranked on GHRM attributes using Fuzzy TOPSIS. Manufacturing organization 4th i.e. MO4 is ranked first followed by MO2, MO1, MO5 and MO3 respectively. The results

Table 9
Pairwise comparison of Green Employee Empowerment and Involvement sub-attributes.

BO	GEI_1	GEI_2	GEI_3	GEI_4	GEI_5	GEI_6	GEI_7
Best criteria: GEI_3	8	4	1	6	7	9	3

OW	Worst criteria: GEI_6
GEI_1	2
GEI_2	4
GEI_3	9
GEI_4	3
GEI_5	2
GEI_6	1
GEI_7	3

Table 10
Pairwise comparison for Green Management of Organizational Culture sub-attributes.

BO	GOC_1	GOC_2	GOC_3	GOC_4	GOC_5	GOC_6
Best criteria: GOC_2	2	1	3	7	4	6

OW	Worst criteria: GOC_4
GOC_1	5
GOC_2	7
GOC_3	3
GOC_4	1
GOC_5	3
GOC_6	2

Table 11
Optimal weights of main attributes of GHRM.

Criteria	Weights	ξ^L
Green Recruitment and Selection (GRS)	0.086	0.03
Green Training and Development (GTD)	0.487	
Green Performance Management System (GPS)	0.051	
Green Pay and Reward System (GPR)	0.129	
Green Employee Empowerment and Involvement (GEI)	0.173	
Green Management of Organizational Culture (GOC)	0.074	

indicate that MO4 performs best on GHRM attributes considered for the present study among all the five organizations.

4.6. Implications of the study

The final results were again presented to the experts for discussion and greater validity. The results were mostly in confirmation with the experts' opinion and several implications were discussed which are presented as follows:

This study has brought forth thirty-nine attributes or practices of GHRM and grouped them into six main categories. This is the first study to provide a comprehensive list of thirty-nine GHRM practices. Organizations are considered as focal to most of the environmental problems due to a large amount of industrial waste and pollution generated by them. Managers are under constant pressure to address this growing environmental degradation challenge; HR managers are also entrusted to contribute towards this cause along with production and environmental managers. The role of HR practices like training in environmental management is widely known in the literature. This study provides a detailed list of GHRM practices that are beneficial to environmental management. HR managers can work towards implementing these practices in their organization. Further, this study ranks GHRM practices using BWM. The prioritization of GHRM practices can help managers to know the importance of practices like green training, green employee empowerment, and designing specific training programs for employees according to environmental needs etc. and work towards their adoption.

This study presents a novel model for evaluation of organizations on certain set of GHRM practices. The managers of other manufacturing organizations can also replicate this model in their organizations and evaluate their position on stated GHRM practices. The model is flexible to adjust new practices or delete certain practices as per the organizations objectives, hence can be implemented by organizations other than those used in the present study.

4.7. Sensitivity analysis

Sensitivity is now widely used by researchers for studies presenting a hybrid model in order to confirm the validity of the results and eliminate any chance of biasness by experts (Gupta and Barua, 2017). To perform sensitivity analysis the criteria obtaining highest weight in BW analysis is varied from 0.1 to 0.9 and consequently weights of all the attributes are varied. Table 16 represents the variation in weights of all the main attributes when weight of GTD is varied.

After obtaining weights of main attributes, first step analysis involves calculating ranking and weights of sub-attributes of GHRM using 9 different runs. The corresponding sensitivity analysis of sub-attributes ranks is presented in Fig. 2.

Next step is to put these sub-attribute weights in Fuzzy TOPSIS analysis and calculate final ranks for all the manufacturing organizations for 9 different runs. Fig. 3 presents a sensitivity analysis for manufacturing organizations ranking.

Figs. 2 and 3 clearly represents that there is not much variability in final ranks of sub-attributes and there is no variability in ranks of manufacturing organizations. Thus, the proposed analysis is free from any biasness and model is robust.

5. Conclusions and scope of future work

Organizations all over the world are inclined towards reduction in environmental degradation based on its functioning; literature has also suggested a significant role of GHRM practices in achieving this objective. GHRM has this ability to inculcate the mindfulness among its current workforce and also encourage new recruits towards ecological improvement and wellbeing. Adopting GHRM practices instill responsibility as well as zeal among employees, train employees and evolve a learning as well open culture within the organization where employees can freely put forth their ideas and experiment towards the greening of the organization. All this results in effective utilization of resources, lesser waste generation, improved work life, improved image of the organizations and overall lesser emissions in the environment.

This study identifies thirty-nine attributes of GHRM and bridges an important gap in the literature regarding lack of empirical studies and that too in a developing country. BWM is used to prioritize the GHRM practices, which is also the first study of its kind. Prioritization of GHRM practices results in important results for HR managers where green training and development is ranked as the most important GHRM

Table 12
Weights of Main and sub-attributes of GHRM.

Main attributes	Weights of main attributes	Sub-attributes	Weights of Sub attributes	Global weights	Ranking
Green Recruitment and Selection (GRS)	0.086	GRS1	0.389	0.034	7
		GRS2	0.144	0.012	20
		GRS3	0.038	0.003	38
		GRS4	0.054	0.005	35
		GRS5	0.072	0.006	31
		GRS6	0.086	0.007	29
		GRS7	0.216	0.019	16
Green Training and Development (GTD)	0.487	GTD1	0.392	0.191	1
		GTD2	0.040	0.020	15
		GTD3	0.053	0.026	11
		GTD4	0.060	0.029	9
		GTD5	0.105	0.051	6
		GTD6	0.210	0.102	2
		GTD7	0.140	0.068	4
Green Performance Management System (GPS)	0.051	GPS1	0.436	0.022	13
		GPS2	0.235	0.012	22
		GPS3	0.117	0.006	32
		GPS4	0.094	0.005	34
		GPS5	0.050	0.003	39
		GPS6	0.067	0.003	37
Green Pay and Reward System (GPR)	0.129	GPR1	0.051	0.007	30
		GPR2	0.086	0.011	23
		GPR3	0.487	0.063	5
		GPR4	0.173	0.022	12
		GPR5	0.129	0.017	17
		GPR6	0.074	0.010	26
Green Employee Empowerment and Involvement (GEI)	0.173	GEI1	0.062	0.011	25
		GEI2	0.125	0.022	14
		GEI3	0.448	0.077	3
		GEI4	0.083	0.014	19
		GEI5	0.071	0.012	21
		GEI6	0.044	0.008	28
		GEI7	0.166	0.029	10
Green Management of Organizational Culture (GOC)	0.074	GOC1	0.220	0.016	18
		GOC2	0.398	0.029	8
		GOC3	0.147	0.011	24
		GOC4	0.051	0.004	36
		GOC5	0.110	0.008	27
		GOC6	0.073	0.005	33

practice; employees need to be trained regarding various green practices being adopted by organizations. Training in specific areas like waste management, recycling, energy management and green purchasing can greatly benefit organization to achieve environmental management goals. Moreover, HR managers need to switch to online training modules, more of digitization rather than traditional pen-paper module to save resources and also inculcate a sense of green management in employees. Employee empowerment and involvement also emerged as an important GHRM practice, employees' involvement in solving environmental problems will result in better sense of responsibility towards organizations green goals. This process will result in enhanced commitment and will also develop a new organizational culture where employees are party to each and every environmental problem. Final phase of three-phase methodology is dedicated to evaluating manufacturing organizations performance w. r.t these GHRM practices. Five organizations were involved in the study and they were ranked according to their performance on GHRM practices using Fuzzy TOPSIS. This methodology can act as a stepping stone for other organizations to measure their performance on various GHRM practices.

Like any other study, this study also suffers from certain limitations. First, this study is based on case study of five manufacturing organizations and involves five experts only. This study can be expanded by taking more organizations and involving more experts. The study can

Table 13
Fuzzy direct comparison matrix for manufacturing organizations alternatives.

	GRS1	GRS2	GRS3	GRS4	GRS5	GRS6	GRS7	GTD1	GTD2	GTD3	...	...	GPR6
MO1	0, 0.2, 0.4	0.8, 1, 1	0, 0.2, 0.4	0.6, 0.8, 1	0, 0.2, 0.4	0.4, 0.6, 0.8	0.2, 0.4, 0.6	0.8, 1, 1	0.8, 1, 1	0, 0, 0.2	...	...	0, 0.2, 0.4
MO2	0.8, 1, 1	0, 0, 0.2	0.6, 0.8, 1	0.2, 0.4, 0.6	0, 0, 0.2	0, 0.2, 0.4	0, 0, 0.2	0.8, 1, 1	0.4, 0.6, 0.8	0, 0.2, 0.4	...	...	0.2, 0.4, 0.6
MO3	0.2, 0.4, 0.6	0, 0.2, 0.4	0.2, 0.4, 0.6	0.2, 0.4, 0.6	0, 0, 0.2	0, 0, 0.2	0.4, 0.6, 0.8	0.8, 1, 1	0.6, 0.8, 1	0, 0.2, 0.4	...	...	0, 0.2, 0.4
MO4	0.6, 0.8, 1	0.4, 0.6, 0.8	0.6, 0.8, 1	0.6, 0.8, 1	0.8, 1, 1	0.8, 1, 1	0.4, 0.6, 0.8	0.8, 1, 1	0.6, 0.8, 1	0.6, 0.8, 1	...	...	0.6, 0.8, 1
MO5	0.6, 0.8, 1	0.4, 0.6, 0.8	0.4, 0.6, 0.8	0.2, 0.4, 0.6	0.2, 0.4, 0.6	0.4, 0.6, 0.8	0.2, 0.4, 0.6	0.6, 0.8, 1	0.4, 0.6, 0.8	0, 0, 0.2	...	...	0.2, 0.4, 0.6
Weights	0.034	0.012	0.003	0.005	0.006	0.007	0.019	0.191	0.020	0.026	...	...	0.010

	GEI1	GEI2	GEI3	GEI4	GEI5	GEI6	GEI7	GOC1	GOC2	GOC3	GOC4	GOC5	GOC6
MO1	0, 0.2, 0.4	0.6, 0.8, 1	0, 0, 0.2	0.6, 0.8, 1	0.6, 0.8, 1	0, 0.2, 0.4	0.4, 0.6, 0.8	0, 0.2, 0.4	0, 0.2, 0.4	0, 0.2, 0.4	0, 0.2, 0.4	0, 0.2, 0.4	0.8, 1, 1
MO2	0.4, 0.6, 0.8	0.6, 0.8, 1	0.6, 0.8, 1	0.4, 0.6, 0.8	0.2, 0.4, 0.6	0.6, 0.8, 1	0, 0, 0.2	0, 0, 0.2	0.6, 0.8, 1	0.8, 1, 1	0.8, 1, 1	0, 0.2, 0.4	0.8, 1, 1
MO3	0.6, 0.8, 1	0.8, 1, 1	0.4, 0.6, 0.8	0, 0, 0.2	0.6, 0.8, 1	0.8, 1, 1	0, 0.2, 0.4	0.4, 0.6, 0.8	0.2, 0.4, 0.6	0, 0.2, 0.4	0.6, 0.8, 1	0, 0, 0.2	0.4, 0.6, 0.8
MO4	0.8, 1, 1	0.8, 1, 1	0.8, 1, 1	0.6, 0.8, 1	0.6, 0.8, 1	0.6, 0.8, 1	0.4, 0.6, 0.8	0.4, 0.6, 0.8	0.8, 1, 1	0.6, 0.8, 1	0.6, 0.8, 1	0.8, 1, 1	0.4, 0.6, 0.8
MO5	0, 0, 0.2	0.6, 0.8, 1	0, 0.2, 0.4	0, 0.2, 0.4	0.6, 0.8, 1	0.4, 0.6, 0.8	0.6, 0.8, 1	0.4, 0.6, 0.8	0.2, 0.4, 0.6	0.2, 0.4, 0.6	0.8, 1, 1	0.8, 1, 1	0.6, 0.8, 1
Weights	0.011	0.022	0.077	0.014	0.012	0.008	0.029	0.016	0.029	0.011	0.004	0.008	0.005

Table 14
Weighted fuzzy evaluation matrix for manufacturing organizations.

	GRS1	GRS2	GRS3	GRS4	GRS5	GRS6	GRS7	GTD1
MO1	(0.000, 0.007, 0.013)	(0.010, 0.012, 0.012)	(0.000, 0.001, 0.001)	(0.003, 0.004, 0.005)	(0.000, 0.001, 0.002)	(0.003, 0.004, 0.006)	(0.004, 0.007, 0.011)	(0.153, 0.191, 0.191)
MO2	(0.027, 0.034, 0.034)	(0.000, 0.000, 0.002)	(0.002, 0.003, 0.003)	(0.001, 0.002, 0.003)	(0.000, 0.000, 0.001)	(0.000, 0.001, 0.003)	(0.000, 0.000, 0.004)	(0.153, 0.191, 0.191)
MO3	(0.007, 0.013, 0.020)	(0.000, 0.002, 0.005)	(0.001, 0.001, 0.002)	(0.001, 0.002, 0.003)	(0.000, 0.000, 0.001)	(0.000, 0.000, 0.001)	(0.007, 0.011, 0.015)	(0.153, 0.191, 0.191)
MO4	(0.020, 0.027, 0.034)	(0.005, 0.007, 0.010)	(0.002, 0.003, 0.003)	(0.003, 0.004, 0.005)	(0.005, 0.006, 0.006)	(0.006, 0.007, 0.007)	(0.007, 0.011, 0.015)	(0.153, 0.191, 0.191)
MO5	(0.020, 0.027, 0.034)	(0.005, 0.007, 0.010)	(0.001, 0.002, 0.003)	(0.001, 0.002, 0.003)	(0.001, 0.002, 0.004)	(0.003, 0.004, 0.006)	(0.004, 0.007, 0.011)	(0.115, 0.153, 0.191)
v_1^+	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$
v_1^-	$v_1^+ = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$

	GTD2	GTD3	…	GPR6	GEI1	GEI2	GEI3	GEI4
MO1	(0.016, 0.020, 0.020)	(0.000, 0.000, 0.005)	…	(0.000, 0.002, 0.004)	(0.000, 0.002, 0.004)	(0.013, 0.017, 0.022)	(0.000, 0.000, 0.015)	(0.009, 0.011, 0.014)
MO2	(0.008, 0.012, 0.016)	(0.000, 0.005, 0.010)	…	(0.002, 0.004, 0.006)	(0.004, 0.006, 0.009)	(0.013, 0.017, 0.022)	(0.046, 0.062, 0.077)	(0.006, 0.009, 0.011)
MO3	(0.012, 0.016, 0.020)	(0.000, 0.005, 0.010)	…	(0.000, 0.002, 0.004)	(0.006, 0.009, 0.011)	(0.017, 0.022, 0.022)	(0.031, 0.046, 0.062)	(0.000, 0.000, 0.003)
MO4	(0.012, 0.016, 0.020)	(0.015, 0.020, 0.026)	…	(0.006, 0.008, 0.010)	(0.009, 0.011, 0.011)	(0.017, 0.022, 0.022)	(0.062, 0.077, 0.077)	(0.009, 0.011, 0.014)
MO5	(0.008, 0.012, 0.016)	(0.000, 0.000, 0.005)	…	(0.002, 0.004, 0.006)	(0.000, 0.000, 0.002)	(0.013, 0.017, 0.022)	(0.000, 0.015, 0.031)	(0.000, 0.003, 0.006)
v_1^+	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	…	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$
v_1^-	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	…	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$

	GEI5	GEI6	GEI7	GOC1	GOC2	GOC3	GOC4	GOC5	GOC6
MO1	(0.007, 0.010, 0.012)	(0.000, 0.002, 0.003)	(0.011, 0.017, 0.023)	(0.000, 0.003, 0.007)	(0.000, 0.006, 0.012)	(0.000, 0.002, 0.004)	(0.000, 0.001, 0.002)	(0.000, 0.002, 0.003)	(0.004, 0.005, 0.005)
MO2	(0.002, 0.005, 0.007)	(0.005, 0.006, 0.008)	(0.000, 0.000, 0.006)	(0.000, 0.000, 0.003)	(0.018, 0.024, 0.029)	(0.009, 0.011, 0.011)	(0.003, 0.004, 0.004)	(0.000, 0.002, 0.003)	(0.004, 0.005, 0.005)
MO3	(0.007, 0.010, 0.012)	(0.006, 0.008, 0.008)	(0.000, 0.006, 0.011)	(0.007, 0.010, 0.013)	(0.006, 0.012, 0.018)	(0.000, 0.002, 0.004)	(0.002, 0.003, 0.004)	(0.000, 0.000, 0.002)	(0.002, 0.003, 0.004)
MO4	(0.007, 0.010, 0.012)	(0.005, 0.006, 0.008)	(0.011, 0.017, 0.023)	(0.007, 0.010, 0.013)	(0.0024, 0.029, 0.029)	(0.007, 0.009, 0.011)	(0.002, 0.003, 0.004)	(0.007, 0.008, 0.008)	(0.002, 0.003, 0.004)
MO5	(0.007, 0.010, 0.012)	(0.003, 0.005, 0.006)	(0.017, 0.023, 0.029)	(0.007, 0.010, 0.013)	(0.006, 0.012, 0.018)	(0.002, 0.004, 0.007)	(0.003, 0.004, 0.004)	(0.007, 0.008, 0.008)	(0.003, 0.004, 0.005)
v_1^+	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$	$v_1^+ = (1, 1, 1)$
v_1^-	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$	$v_1^- = (0, 0, 0)$

Table 15
Final ranking of manufacturing organizations. The analysis results of Fuzzy TOPSIS show that manufacturing organization 4 (MO4) is ranked first in GHRM practices.

	D+	D-	Ci	Rank
MO1	38.428	0.599	0.015	3
MO2	38.390	0.634	0.016	2
MO3	38.540	0.492	0.013	5
MO4	38.167	0.845	0.022	1
MO5	38.452	0.577	0.015	4

also use statistical methods like SEM to validate the results. Also, only manufacturing organizations were taken up for the study as they are major contributors to environmental degradation but a comparative study with service organizations can also give better results. Other MCDM (Multi Criteria Decision Making) techniques like VIKOR (VlseKriterijuska Optimizacija I Komoromisno Resenje), ELECTRE (Elimination and Choice Expressing Reality), ISM (Interpretive Structural Modeling) etc. can be used to compare the results of BWM with them.

Table 16
Variation in weights value for all main attributes after varying GTD weight value.

Attributes of GHRM	Normalized Weight	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9
GTD	0.487	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
GEI	0.173	0.303	0.269	0.235	0.202	0.168	0.135	0.101	0.067	0.034
GPR	0.129	0.227	0.202	0.177	0.151	0.126	0.101	0.076	0.050	0.025
GRS	0.086	0.151	0.135	0.118	0.101	0.084	0.067	0.050	0.034	0.017
GOC	0.074	0.130	0.115	0.101	0.087	0.072	0.058	0.043	0.029	0.014
GPS	0.051	0.089	0.079	0.069	0.059	0.049	0.040	0.030	0.020	0.010

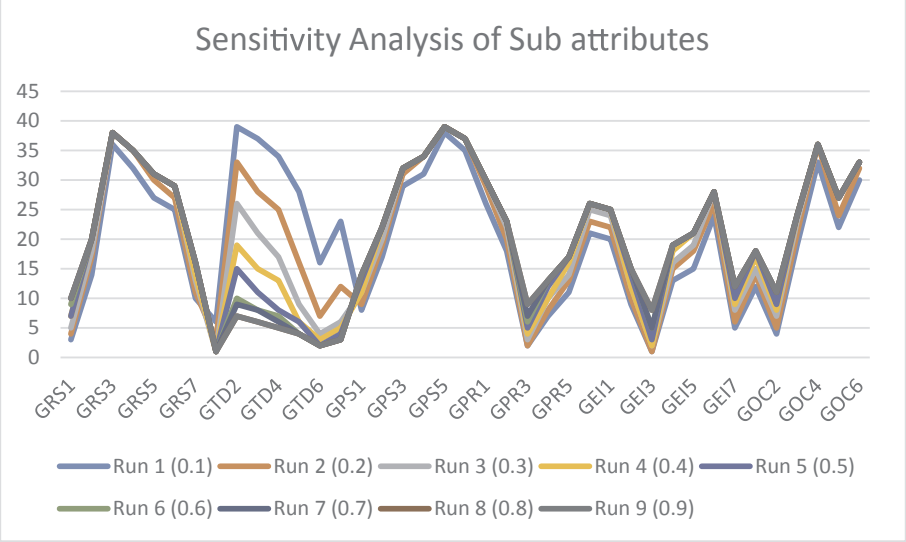

Fig. 2. Sensitivity analysis for sub-attributes ranks.

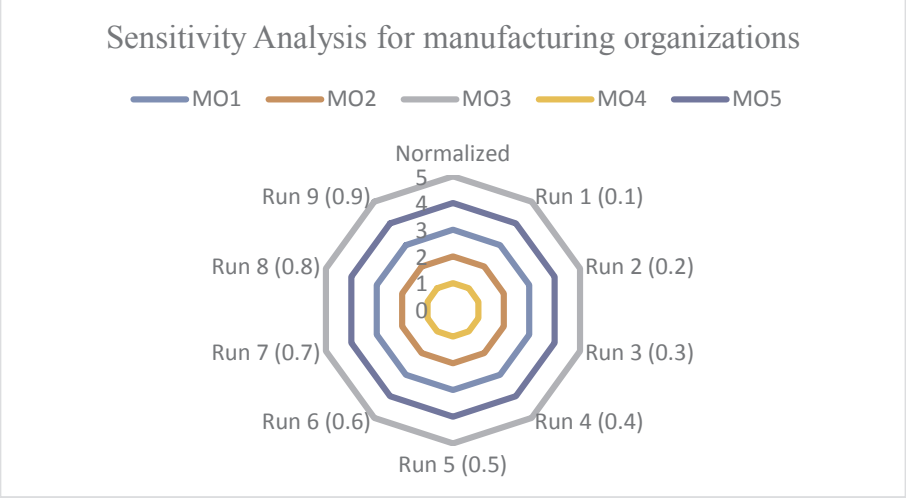

Fig. 3. Sensitivity analysis for manufacturing organizations ranks.

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