**The moderating effect of big data analytics on green human resource management and organizational performance**

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**Abstract**

Green human resource management (GHRM) practices and big data analytics are becoming critical to enhance organizational performance through improved management and utilization of scarce resources. However, limited research has thus far been carried out on GHRM practices and organizational performance in the presence of big data analytics. Therefore, the objective of this study is to investigate the moderating effect of big data analytics on the relationship between GHRM practices and organizational performance. This quantitative and explanatory study adopted a survey instrument to collect cross-sectional data from 189 respondents working in different organizations in Pakistan. The findings reveal a significant and positive effect of all GHRM practices on organizational performance. In addition, a substantial increase in the R square models for all three dimensions of big data analytics as a moderator was found on the relationship between GHRM practices and organizational performance. The empirical study significantly enhances our understanding of how GHRM practices substantially influence organizational performance along with the use of big data analytics to maximize the benefits of GHRM and improve organizational efficiency. The study highlights the need to further explore green activities and behaviors for enhancing business value and competitive advantage. In addition, adoption of big data analytics supports faster decision-making, saves time and underpins efficient resource utilization to achieve operational and strategic efficiencies.

**Keywords:** Green human resource management practices, big data analytics, organizational performance.

**1. Introduction**

Over the last few decades, green human resource management (GHRM) and big data have been identified as critical elements impacting how modern organizations are changing the way they conduct operations. In this regard and for the efficient and effective management of operations, technological advancement and increased pressure from stakeholders have spurred organizations to identify and implement economical and sustainable practices to enhance organizational performance (El-Kassar & Singh, 2019). In order to improve performance, the efficient use of organizational resources while creating more economic value through GHRM and eco-friendly activities has become one of the foremost challenges for organizations (Chang & Chen, 2013). Indeed, the intensive rise in globalization and fierce market competition calls for sustainable solutions through adopting best practices for GHRM and applying data analytics for improved decision-making (Mousa & Othman, 2020), which is becoming a significant concern for organizations with competitive structures and societal burdens ( Zaid, Talib & Jaaron, 2018). In this context, many organizations have started using GHRM practices and adopted big data analytical techniques to enhance the level of efficiency and gain a competitive advantage (Obeidat, Al Bakri, & Elbanna, 2020).

The resource-based view of the organization posits that resources are the key drivers of organizational outcomes and strategic performance (Salman et al., 2020). Therefore, in order to enable improved management and utilization of scarce resources, GHRM is becoming a critical issue in developing business strategy, which plays a significant role in achieving performance and gaining a competitive advantage (Hameed et al. 2020). To achieve substantial performance in a competitive environment, there is a need to adopt green practices in the organization on a larger scale and particularly GHRM practices. Thus, GHRM practices act as a catalyst for businesses to help realize sustainability and support an organization's competitive advantage (Jabbour & de Sousa, 2016). Although, Ren, Tang & Jackson (2018) highlighted that the impact of GHRM practice on organizational performance has remained unsubstantiated and more studies are needed to identify the impact of new technologies (particularly big data analytics) on organizational performance. Nevertheless, GHRM practices with the integration of green technology and in the context of organizational performance have remained unaddressed despite its rising importance. Indeed, GHRM practices are now becoming a primary concern due to customer and shareholder pressure on organizations to improve their economic, environmental, and social performance (Zameer, Wang, & Yasmeen, 2020).

The literature reveals that a number of studies have been conducted to investigate the impact of GHRM practices on organizational performance (Obeidat et al., 2020). This includes developing and enhancing the capability of big data analytics to achieve organizational performance (Gupta et al. 2020; Mishra et al. 2019), however, no research has been conducted thus far to examine the relationship between GHRM practices and organizational performance in the presence of big data analytics. Accordingly, Dubey et al. (2019) and Yong, Yusliza, & Fawehinmi (2019) suggested that future research must be carried out on GHRM and organizational performance in relation to big data. In this context, GHRM practices and big data analytics are becoming an active area of interest for both researchers and practitioners. However, in many cases, studies are restricted to understanding certain aspects, such as the benefits and capabilities of big data analytics (Wang et al., 2018); big data impact on supply chain management (SCM), corporate social responsibility (CSR) and organizational management (Wang et al., 2020; Gunasekaran et al., 2017); achieving superior organizational performance (Gupta et al., 2020); enhancing organizational capabilities and performance (Mishra et al., 2019), critical analysis of big data challenges (Sivarajah et al., 2017); creating analytic culture and analytic-based decision making (Thirathon et al., 2017); greening big data (Wu et al., 2016); and the literature review on the impact of big data (Wamba et al., 2015).

Moreover, other studies have been conducted on GHRM that are limited to investigating specific circumstances, such as exploring the challenges and solutions for a sustainable workplace (Islam et al., 2020); enhancing the role in corporate sustainability and social responsibility (Stahl et al., 2020); promoting employees performance (Saeed et al., 2019); identifying impact on sustainable performance of healthcare organization (Mousa & Othman, 2020; Pinzone et al., 2016); enabling environmental performance for the oil and gas industry (Obeidat et al., 2020); investigating employees’ performance behavior toward environmental performance (Hameed et al., 2020; Kim et al., 2019); and development of measurement scales (Shah, 2019). The studies of Yong et al. (2019) and Ren et al. (2018) were confined to a systematic review and future directions for GHRM. Further, the study by Zaid et al. (2018) was limited to investigating the GHRM bundle practices of manufacturing organizations. Therefore, this research study aims to answer the following research questions: a) what is the impact of GHRM practices on organizational performance?; and b) what is the moderating effect of big data analytics on the relationship between GHRM practices and organizational performance?

The motivation and uniqueness of this empirical research study can be related to the literature that reveals the scarcity of research conducted with respect to examining the moderating effect of big data analytics on GHRM practices and organizational performance. As such, Wang et al. (2020) investigated the moderating effect of big data analytics capability on the relationship between corporate social responsibility (CSR), green supply chain management (SCM) and firm performance. However, this study was limited to SCM, CSR and the moderating effect of one dimension of big data analytics (capability), which neglected to investigate the dimensions of big data acceptance, big data adoption, and big data assimilation. Consequently, it is rare that any study has considered big data analytics in the context of GHRM and organizational performance as well as the dimensions of big data analytics (namely acceptance, adoption, and assimilation) as an intervening variable. Thus, this empirical study makes an effort to significantly contribute towards the body of knowledge and fill the aforementioned research gaps in order to provide future research avenues and implications for both academicians and practitioners.

The remainder of the article is organized in the following manner. Next, the literature review is provided in the context of green human resource management practices, big data analytics, and organizational performance, followed by hypotheses development. Then, research methods covering population and sampling, data collection methods, response rate and demographic data are presented. Afterwards, the analysis and findings based on research hypotheses are described. Finally, discussions, implications, conclusions, limitations and future research directions are explained.

## **2. Literature review**

## ***2.1 Green human resource management (GHRM)***

GHRM practices encourage employee's positive attitudes and behavior towards environmental protection (Chaudhary, 2019) and it has been suggested that adopting GHRM practices is critical for organizational business strategy (Hameed et al. 2020). Organizations adopt GHRM practices to use information technology (IT) tools and techniques in day-to-day operations with the objective of reducing the organization’s carbon footprint (Mandip, 2012). Implementation of GHRM practices reflects how the organization is concerned for its employee's well-being and how it cares about environmental issues (Islam et al. 2020). The literature demonstrates classification among internal and external factors that are acting as an obstruction to GHRM practices. Internal factors such as upbringing and the persona of an individual; and external factors like the digital divide are acting as a barrier to GHRM implementation (Vahdati, 2018). Renwick et al. (2013) stated three broader practices associated with organizations ‘going green’: namely, developing green ability, green employees' motivation, and providing green opportunities to employees that enable organizations to achieve sustainable performance.

The resource-based view (RBV) of strategy theory explains that organizational support plays an important role in reducing the toxicity of workplace environments that contributes to energizing and motivating team members to increase their performance and productivity, which ultimately improves the organizational performance (Wang, Zaman, Rasool, uz Zaman, & Amin, 2020). To enhance organizational performance, it is significant to comply with green obligations within available resources along with appropriate structuring of the job, suitable rewards, compensations, and green awareness to support employees' involvement in green tasks (Dumont, Shen, & Deng, 2017). Green performance indicators are essential in green performance management systems to measure green goals and targets for achieving organizational objectives (Saeed et al., 2019). The most desirable green performance management technique is to link green rewards with green targets identified during the performance appraisal process to enhance environmental initiatives involving internal and external factors (Zubair & Khan, 2019). Further, GHRM encompasses incorporating the organization's ecological management goals into the HR processes, namely, recruitment & selection, training & development, performance management & evaluation, rewards & recognition (Renwick et al., 2013). These practices have a significant relationship with organizational performance, growth, and productivity (Yusoff, Nejati, Kee, & Amran, 2020).

## ***2.2 Big data analytics (BDA)***

Big data analytics is defined as the capability to provide business insights using data management infrastructure (i.e. technology) and talent (i.e. personnel) to translate business into a competitive force. Since traditional analytical systems are not capable of big data management, modern big data analytics are considered more credible, integral, and secure (Sivarajah, Kamal, Irani, & Weerakkody, 2017). Organizations benefit from big data through optimized resource usage as resource efficiency (Shuja et al., 2017). Furthermore, big data can be viewed as the data that is too big to process comfortably (Scott et al., 2016), which also has the capacity to increase the understanding and facilitate executives' timely decision-making (Duan & Xiong, 2015). The big data of organizations can be analyzed through big data analytics and techniques (Wu et al. 2016). Nowadays, almost every organization faces issues relating to a vast amount of data generated by internal (e.g., employees) and external stakeholders (e.g., suppliers, customers, etc.). Furthermore, big data is generated by cloud computing, the Internet of Things (IoT), artificial intelligence, and social media platforms (Bibri, 2018).

Big data can be described in terms of volume, variety, and velocity (Duan & Xiong, 2015). Additionally, Wamba et al. (2015) characterized big data by adding two more features, i.e. veracity and value. Hampton et al. (2013) elaborated that big data cannot be managed through traditional data approaches in terms of its acquisition, accessibility, and application in real-time. Since traditional analytical systems are not capable of big data management, modern big data analytics are considered more credible, integral, and secure (Sivarajah et al. 2017). Advanced big data analytics employs various tools (such as Hadoop, Spark, HBase and MongoDB) and techniques (i.e., data mining and machine learning) that extract meaningful and accurate information to support decision-making processes (Bibri, 2018). These tools provide informed decision-making, discover valuable knowledge, identify consumer desires and expectations, and create advanced solutions. Furthermore, big data is a growing topic of interest for both academics and practitioners because humans and computers continue to produce and exchange vast quantities of data at an incredible pace that is becoming a significant characteristic of the global economy (Calza, Parmentola, & Tutore, 2020).

***2.3 Organizational performance***

Organizations tend to achieve sustainable growth by maintaining high competitiveness and performance (Puška, Kozarević, & Okičić, 2020). Performance is generally based on the premise that organizations gather productive assets to accomplish common goals, which includes three areas related to the organization, namely: financial return,  shareholder return, and the market performance of product/service (Al Khajeh, 2018). Abu-Jarad, Yusof, and Nikbin (2010) view organizational performance as an organizations' capacity to accomplish goals and objectives by using efficient and adequate resources. Organizational performance is evaluated in terms of financial and non-financial measures.. To achieve high performance, organizations develop long-term relationships with the main stakeholders including suppliers, customers, and employees. The performance is typically measured by ‘cost’ and ‘customer response’ but other qualitative indicators are also used, which include customer satisfaction, stakeholder performance, information flow integration and flexibility (Puška et al., 2020).

Abu-Jarad, Yusof, & Nikbin (2010) concluded that organizational performance is the capacity of organizations to accomplish goals and objectives through efficient and productive resources. Theories related to resource management suggest that resources are valuable, rare, and inimitable. Building on these assumptions that resources are scarce and limited, organizations maintain unique and viable competitive positions based on their resources (Miles, 2012). Successful organizations identify high influential factor performance and take corrective actions in an effective manner and timely basis (Khan, Hassan, Kusi-Sarpong, Mubarik, & Fatima, 2021). To improve organizational performance, organizations focus on GHRM practices for continuous improvement that are consistent with organizational policy (Habidin, Hibadullah, Mohd Fuzi, Salleh, & Md Latip, 2018).

***2.4 Development of hypotheses***

As mentioned, resource management theories posit that organizational resources need to be valuable, rare, and inimitable for companies to secure competitive advantages in the marketplace. Therefore, for effective management of resources, GHRM practices can be adopted to enhance organizational performance, where job analysis is one of the practices that play a key role in organizations. Job analysis is a systematic process in which job duties, responsibilities, job requirements and working conditions are analyzed (Dessler & Tan, 2009). Organizations can make efforts to include environmental management tasks in job description, which reflects the core duties and responsibilities as well as societal and environmental obligations for enrichment in business values and principles (Shah, 2019). Indeed, green job descriptions demonstrate the environmental tasks, job skills, and individual knowledge desired to carry out green activities (Chaudhary, 2018). To improve productivity and organizational performance, green job analysis and the design of cross-functional teams are introduced by organizations (Mehta & Chugan, 2015). Thus, green job analysis and design can be practiced to enhance organizational performance.

*H1: There is a significant relationship between* *green job analysis & design and organizational performance.*

Organizations maintain unique and viable competitive positions in spite of scarce and limited resources (Miles, 2012). For optimal utilization of organizational resources, the green recruitment process includes virtual screening or video conferencing instead of doing direct interviews. This virtual approach involves using software applications (e.g., Skype and Zoom), electronic methods for the meeting, and group interviews for recruiting candidates according to green practices (Shahriari et al., 2019). Green recruitment and selection provide avenues for organizations to recruit candidates with a green mindset to perform their primary duties and be socially responsible for conserving environment and natural resources (Ahmad, 2015). Organizations are taking an active interest in applying sustainability concepts through green recruitment and selection of human resource (Babaeinesami, Tohidi, & Seyedaliakbar, 2021). Further, green recruitment and selection help organizations to utilize resources efficiently and outperform in the competitive environment.

*H2: There is a significant relationship between* *green recruitment and organizational performance.*

GHRM practices are adopted to improve organizational efficiency where green training increases employees' skills and knowledge to perform environmental activities (Fernández, Junquera, & Ordiz, 2003). Teixeira et al. (2016) emphasized that green training is one of the most critical factors to conserve energy, reduce waste, and enhance environmental awareness within an organization that helps shift towards a more sustainable environment. Green training and development ultimately enhance employees' engagement in achieving green goals and objectives. Moreover, training and development in GHRM practices help in developing processes that organize, manage, lead and motivate the teams (Rahmanniyay & Yu, 2019). . Green training and development help employees to understand and develop process to enhance organizational performance.

*H3: There is a significant relationship between* *green training & development and organizational performance.*

Green performance management relates to performance appraisal with green objectives and tasks defined in the job description (Mehta & Chugan, 2015). According to Opatha & Arulrajah (2014), green performance management is a tool for enhancing individual, group, and organizational performance towards green-based goals. Green aligned performance indicators deal with formulating green criteria for all employees in performance appraisals that entail environmental incidents, environmental measures, and communication of ecological concerns and policies (Tang et al. 2018). For successful implementation of green performance management systems, one of the best approaches to adopt is to link performance evaluations with job descriptions that are based on specific green focused tasks and duties (Jyoti, 2019). Therefore, effective green performance management is likely to increase organizational performance.

*H4: There is a significant relationship between green performance management and organizational performance.*

Green compensation and rewards are used to enhance the enthusiasm and motivation of employees for improving productivity in organizations (Nalini & Durai, 2019). Compensation and reward is considered as one of the major components of GHRM to provide rewards and benefits to employees based on their performance (Dutta, 2012). Obeidat et al. (2020) acknowledged that rewards and compensation are recognized as the most crucial tools for managing organizations' environmental concerns and activities from the GHRM perspective. Moreover, offering employees a compensation package that rewards green performance requires a compensation and performance evaluation system to be integrated with green-based goals and targets (Uddin & Islam, 2015). Performance evaluation can be used as a management tool for retention and compensation of employees (Yadav, Singh, & Rajeshwari, 2012). Further, green-based compensation management can be used a systematic process to develop and implement policies for rewarding employees to enhance organizational productivity and performance.

*H5: There is a significant relationship between* *green compensation management and organizational performance.*

GHRM practices are adopted for the efficient utilization of resources and enhance organizational productivity. Green health and safety play a key role in improving health and safety of employees as well as providing a green environment with reduced stress and harmful effects (Hameed et al., 2020). Organizations are striving to improve sustainability through effective health and safety policies for employee, which can be extended to include environmental concerns and issues (Sharaf & Khalil, 2021). Green health and safety includes traditional health and safety practices along with enhanced environmental management features. Shah (2019) elaborated that it involves efforts to decrease worker stress and job‐related sickness instigated by harmful work settings and initiate services to protect the environment and community livelihoods. Green health and safety practices ultimately help in minimizing harmful consequences to avoid health issues and improve employees' well-being. Green health and safety management play a key role to improve organization image, customer satisfaction, and sustainable performance in the long-run.

*H6: There is a significant relationship between* *green health & safety and organizational performance.*

**Organizational Performance**

Big Data Acceptance

Big Data Adoption

Big Data Assimilation

**Big Data Analytics**

**Figure 1. Research Model**

Green Job Analysis & Design

Green Recruitment & Selection

Green Training & Development

Green Performance Management

Green Compensation Management

Green Health and Safety

Green Employee Involvement & Relations

**GHRM Practices**

Employees are encouraged to participate in creative ideas (Pham et al. 2019). Green employee relations and involvement are critical to the effective execution of environmental management plans and services. Tang et al. (2018) emphasized that green employee relations and involvement inspire employees to engage and protect the environment from harmful hazards and conserve natural resources. Pinzone et al. (2016) revealed that employees' involvement in environmental activities and decision-making results in enhancing green activities and environmental initiatives. Green and positive employee relations act as a source of competitive advantage and can be viewed as a long-term asset for any organization that helps to resolve conflicts and problems which arise in the workplace (Ahmad 2015). Green involvement of employees opens up several formal and informal communication channels to foster a green culture as well as green facilities for increasing organizational performance and productivity (Tang et al., 2018). Moreover, green employee involvement and relations help in improving working relationships with supervisors towards achieving organizational performance.

*H7: There is a significant relationship between* *green employee involvement & relation and organizational performance.*

Big data analytics is used to characterize large data sets in order to extract valuable information from the data related to data governance and privacy concern (Pramanik, Mondal, & Haldar, 2020). Big data analytics improves the capability of organizations to make timely decisions and enhance organizational performance through GHRM practices (Akter et al., 2016). El-Kassar & Singh (2019) articulated that acceptance of big data analytics in organizations can be considered as one of the drivers of green innovation, organizational performance, and competitive advantage. Indeed, tools for big data analytics can make available more information to business organizations although such tools do not necessarily guarantee data quality. Nevertheless, organizations must have capabilities to utilize big data and transform such data into information for improved decision-making through adoption of big data analytics, which has become a critical factor in determining organizational performance (Shollo & Kautz, 2010). Furthermore, acceptance of big data analytics can significantly impact on GHRM practices within organizations and the ability to improve organizational performance (Low, Chen, & Wu, 2011).

*H8: Big data acceptance moderates the relationship between GHRM practices and organizational performance.*

Organizations adopt big data analytics for efficient and effective utilization of resources (Khan, 2021). Big data analytics is used by leading companies to outperform rivals in enhancing corporate efficiency, improving decision-making, and changing the supply chain dynamics ( Schoenherr & Speier‐Pero, 2015). The adoption of big data analytics faces several barriers. Also, the use of large-scale data is becoming a major challenge for organizations in the present dynamic business environment and consequently organizations require supportive infrastructure and technical capabilities to manage big data (Dubey et al., 2019). However, the effective adoption of data analytics is the key to derive valuable insights from big data to enhance job performance and promote GHRM practices (Watson, 2012). Papadopoulos, Ilia, & Markatos (2018) suggested that big data analytics can improve overall performance and the strategic capacity of organizations as well as create avenues to develop strategies for competitive advantages through GHRM practices. Big data adoption is linked to an effective organizational strategy that allows technology to be integrated into its business processes (Wang, Kung, & Byrd, 2018). Thus, big data adoption can lead to improved organizational performance through harnessing GHRM practices.

*H9: Big Data adoption moderates the relationship between GHRM practices and organizational performance.*

Organizations are facing problems associated with transforming data into meaningful information to improve business performance (Pramanik et al., 2020). To enhance organizational performance, organizations can take advantage of big data for unleashing new organizational capabilities and values (Braganza et al. 2017). Indeed, big data analytics acts as a driver in implementing green practices and achieving sustainable organizational performance (El-Kassar & Singh, 2019). Dubey et al. (2019) and Yong, Yusliza, & Fawehinmi (2019) advocate the need to explore the relationship between GHRM practices and organizational performance in the presence of big data analytics. Big data analytics is still an emerging field and hence there is a need for researchers to play closer attention to both the challenges and opportunities in this arena (Ahmed & Yüzbaşı, 2016). Furthermore, big data analytics provide real-time micro-segmentation of customers, improve and support decision-making and enable new business models for products and services. The assimilation stage refers to how well technology has been implemented to achieve the organizational goals (Wang et al., 2018), where big data analytics facilitate improvement in organizational performance (Singpurwalla, 2016). Thus, big data assimilation can improve the relationship between GHRM practices and organizational performance.

*H10: Big Data assimilation moderates the relationship between GHRM practices and organizational performance.*

3. Materials and methods

***3.1 Population and sampling***

The explanatory research paradigm was followed for this quantitative study where GHRM practices, big data analytics, and organizational performance were measured through adapted questionnaire instruments. The population of the study were employees working in different public and private organizations in Pakistan ,which are following GHRM practices and adopting big data analytics. These public and private organizations belong to different industries, including education, health, manufacturing, construction & infrastructure, financial services, defense, IT & telecommunications, professional services, and energy. In this study, the convenience sampling technique was employed due to non-availability of a standard list of organizations and employees, which have implemented GHRM practices and big data analytics. Moreover, a sample of 250 was selected based on the sample size of earlier studies conducted in the context of GHRM and big data analytics as well as according to the study by Ahmed et al. (2020) regarding sample size. To qualify as a participant, the respondents need to be key informants of the concepts and theory being investigated and have meaningfully been involved in the activities being studied (Pesämaa, Zwikael, HairJr, & Huemann, 2021). Therefore, the respondents were selected from all three organizational tiers; i.e., senior management, middle management and lower management who were involved in GHRM practices and big data analytics. The selection of the sample from various industries of public and private sectors as well as the respondents from different tiers of organizations, help to maximize the generalizability of this research and minimize the chances of bias in the sample data.

***3.2 Measurement of variables***

The study adopted the scales for measurement of variables from earlier research studies. For this purpose, 40 items from Shah (2019) were adapted to measure GHRM practices. Additionally, 12 items were adapted from George et al. (2014), Hazen et al. (2012) and Srinivasan & Swink (2018), to measure the dimensions of big data analytics (namely big data capability, big data adoption, and big data assimilation). Plus, 6 items were adapted from Zack, McKeen & Singh. (2009) to measure organizational performance. All these items were anchored on a 5-point Likert rating scale from ‘strongly disagree’ to ‘strongly agree’ to measure the variables of the study.

***3.3 Data collection methods***

Data was collected from various organizations from the public and private sectors across Pakistan, including education, health, manufacturing, defense, IT & telecommunications, professional services and energy. The data was collected from employees of three tiers (i.e. senior management, middle management, and lower management) of the targeted population who were involved in adoption of GHRM practices and big data analytics in their respective organizations. Respondents were asked to participate only if they have knowledge or have been involved in the implementation of big data analytics and GHRM practices to improve efficiency of their organizations. The survey questionnaire was classified into four parts. In addition to the demographic data, a total of fifty-eight items were included in the questionnaire. The second part contained 40 items to measure the seven-dimensional variable, i.e. GHRM practices adapted from Shah (2019). The third part covered big data analytics and comprised 12 items on big data capability/acceptance, big data adoption, and big data assimilation which were adapted from Srinivasan & Swink (2018). The fourth and last part contains 6 items to measure organizational performance adopted from the work of Zack et al. (2009).

***3.4 Response rate and demographic data***

The survey instrument was distributed among 250 professionals, out of which 200 responses were received from all three tiers at senior, middle and lower management. We eliminated 11 responses with incomplete information; thus, 189 were usable survey responses for data analysis. The overall response rate of 80% was received from the respondents who were male (76.2%) and female (23.8%); of public sector (31.7%) and private sector (61.4%) and others (13%); having qualifications at Bachelor’s degree (3.7%), Master’s degree (23.8%), MS/MPhil degree (35.4%) and PhD degree (37%). The respondents have working professional experience of up to 3 years (48.1%), 3-5 years (23.3%), 5-10 years (16.4%),10-15 years (10.1%) and above 15 years (2.1%). The summary of demographic data is presented in Table 1.

Table 1. Demographic results from survey

|  |  |  |  |
| --- | --- | --- | --- |
| **Demographic** | **Item** | **Frequency** | **Percent** |
| Gender | Male | 144 | 76.2 |
|  | Female | 45 | 23.8 |
| Education | Bachelor Degree | 7 | 3.7 |
|  | Master Degree | 45 | 23.8 |
|  | MS/Mphil Degree | 67 | 35.4 |
|  | PhD Degree | 70 | 37.0 |
| Experience | < 3 Year | 91 | 48.1 |
|  | 3 to 5 Years | 44 | 23.3 |
|  | 5 to 10 Years | 31 | 16.4 |
|  | 10 to 15 Years | 19 | 10.1 |
|  | > 15 Years | 4 | 2.1 |
| Sector | Public | 60 | 31.7 |
|  | Private | 116 | 61.4 |
|  | Other | 13 | 6.9 |
| Industry | Education | 54 | 28.6 |
|  | Health | 30 | 15.9 |
|  | Manufacturing | 6 | 3.2 |
|  | Construction & infrastructure | 6 | 3.2 |
|  | Financial Services | 31 | 16.4 |
|  | Defense | 6 | 3.2 |
|  | IT & Telecom | 17 | 9.0 |
|  | Professional Services | 14 | 7.4 |
|  | Energy | 1 | 0.5 |
|  | Others | 24 | 12.7 |
| Position | Senior Management | 27 | 14.3 |
|  | Middle Management | 117 | 61.9 |
|  | Lower Management | 45 | 23.8 |

4. Results

Reliability and validity analyses were performed to check the internal and external consistency of sample data collected through the survey instrument. For validity purposes, the principal component analysis test was conducted to check the sampling adequacy and analyze the linear relationship between all variables, i.e. GHRM practices, big data analytics, and organizational performance. Two assumptions of factor analysis using principal component analysis must be fulfilled to observe the moderation effects, i.e. Kaiser-Meyer-Olkin (KMO) and the Bartlett test. The value of KMO should be greater than 0.60 to determine the suitability of sample data for factor analysis, and the Bartlett test must be significant at 5% in order to check the redundancy among the variables of the study (Pallant, 2001). The KMO value for measuring the sampling adequacy for organizational performance is 0.753, which is acceptable as it is above the 0.60 cut-off value. KMO values for big data analytics and GHRM practices were 0.850 and 0.934, respectively, and above the cut-off value. Also, the values obtained from the Bartlett test of sphericity, where all sub-items have a p-value <0.1 respectively, thereby indicating that the correlation matrix is not an identity matrix, and therefore construct validity exists. There were no missing values in the items ranged from 0.693 to 0.934. Therefore, factor loadings of all items were above the cut-off value of 0.40. Based on Kaiser's (1960) criterion, the eigenvalues for each factor were obtained; factors with values equal to one or greater were extracted. Besides the validity, the reliability was examined by calculating Cronbach’s alpha in order to check that reliability is well above the threshold of 0.70 for all variables of the study. Accordingly, the reliability test of all items was performed and the Cronbach’s alpha values for all the variables were greater than 0.80, which shows exceptional internal consistency among items except big data adoption and was 0.76. The summary of validity and reliability analyses are presented in Table 2.

Table 2. Summary of validity and reliability analyses

| **Variables of Study** | **KMO Test** | **Bartlett's Test** | **df** | **Sig** | **No. of Items** | **Cronbach's Alpha (**α**)** |
| --- | --- | --- | --- | --- | --- | --- |
| ***Green HRM Practices*** | ***0.934*** | ***6004.110*** | ***780*** | ***0.000*** | ***40*** | ***0.97*** |
| Green job design | 0.767 | 327.961 | 10 | 0.000 | 5 | 0.81 |
| Green recruitment and selection | 0.867 | 524.350 | 21 | 0.000 | 7 | 0.86 |
| Green training and development | 0.921 | 1079.870 | 36 | 0.000 | 9 | 0.92 |
| Green Performance Management | 0.904 | 649.733 | 15 | 0.000 | 6 | 0.90 |
| Green compensation management | 0.872 | 570.303 | 10 | 0.000 | 5 | 0.90 |
| Green health and safety | 0.674 | 221.616 | 3 | 0.000 | 3 | 0.82 |
| Green involvement and relation relations | 0.869 | 483.281 | 10 | 0.000 | 5 | 0.88 |
| ***Big Data Analytics*** | ***0.850*** | ***1079.921*** | ***66*** | ***0.000*** | ***12*** | ***0.89*** |
| Big Data Analytics Capability | 0.801 | 399.592 | 10 | 0.000 | 5 | 0.84 |
| Big Data Adoption / Acceptance | 0.693 | 139.027 | 3 | 0.000 | 3 | 0.76 |
| Big Data Assimilation | 0.767 | 266.574 | 6 | 0.000 | 4 | 0.81 |
| ***Organizational Performance*** | ***0.753*** | ***483.779*** | ***15*** | ***0.000*** | ***6*** | ***0.84*** |

The mean values ranged from the highest 4.075 to the lowest 3.241. The organizational performance results indicated the highest conformity (Mean = 4.075, Standard Deviation = 0.671). Green compensation management is the lowest indicator (Mean = 3.241, Standard Deviation = 0.840) reflects the conformity of respondent's perception regarding these items. We used Pearson's Correlation, which measures the relationship between two continuous variables and covariance. To find the strength of the relationship between variables, the correlation value was computed between each dimension of GHRM practices and each dimension of big data analytics with organizational Performance. The results indicate that a significant positive relationship exists between GHRM practices and the dimensions of big data analytics, and the organization's performance itself. All of the results have a p-value <0.01. The summary of correlation analysis is provided in Table 3.

Table 3: Summary of correlation analysis

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr** | **Variable** | **Mean** | **SD** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** |
| 1 | Green Job Design | 3.537 | 0.657 | 1 |  |  |  |  |  |  |  |  |  |  |
| 2 | Green Recruitment and Selection | 3.378 | 0.716 | 0.620\*\* | 1 |  |  |  |  |  |  |  |  |  |
| 3 | Green Training and Development | 3.402 | 0.712 | 0.595\*\* | 0.779\*\* | 1 |  |  |  |  |  |  |  |  |
| 4 | Green Performance Management | 3.268 | 0.804 | .501\*\* | 0.700\*\* | 0.784\*\* | 1 |  |  |  |  |  |  |  |
| 5 | Green Compensation Management | 3.241 | 0.840 | 0.449\*\* | 0.664\*\* | 0.769\*\* | 0.776\*\* | 1 |  |  |  |  |  |  |
| 6 | Green Health and Safety | 3.567 | 0.792 | 0.467\*\* | 0.494\*\* | 0.529\*\* | 0.529\*\* | 0.566\*\* | 1 |  |  |  |  |  |
| 7 | Green involvement and relation | 3.410 | 0.753 | 0.568\*\* | 0.724\*\* | 0.778\*\* | 0.761\*\* | 0.748\*\* | 0.701\*\* | 1 |  |  |  |  |
| 8 | Big Data Acceptance | 3.668 | 0.696 | 0.418\*\* | 0.405\*\* | 0.379\*\* | 0.349\*\* | 0.336\*\* | 0.479\*\* | 0.416\*\* | 1 |  |  |  |
| 9 | Big Data Adoption | 3.739 | 0.694 | 0.299\*\* | 0.125\*\* | 0.168\*\* | 0.211\*\* | 0.132\*\* | 0.320\*\* | 0.224\*\* | 0.464\*\* | 1 |  |  |
| 10 | Big Data Assimilation | 3.668 | 0.671 | 0.374\*\* | 0.332\*\* | 0.349\*\* | 0.278\*\* | 0.298\*\* | 0.359\*\* | 0.350\*\* | 0.612\*\* | 0.507\*\* | 1 |  |
| 11 | Organizational Performance | 4.075 | 0.671 | 0.363\*\* | 0.330\*\* | 0.337\*\* | 0.261\*\* | 0.329\*\* | 0.505\*\* | 0.416\*\* | 0.481\*\* | 0.335\*\* | 0.407\*\* | 1 |
| \*P<0.05, \*\*P<0.01. | | | | | | | | | | |  |  |  |  |

Regression analysis was employed to test the research hypothesis (Hair et al. 2018) and moderation occurs when the effect of an independent variable varies on the dependent variable varies across levels of the moderating variable (Anderson, Sweeney, & Williams, 2011). The interaction term's regression coefficient provides an estimate of the moderating effect was also estimated (Hair et al., 2018).

The p-value for the H1 test was 0.000, which is <0.05; this indicates that every unit of change in the green job analysis and design practices will bring a 13.2% change in the organizational performance, so the relationship is significant. Also, the standardized beta value indicated a positive and significant relationship (β = 0.363, p <0.001). Similarly, the p-value for H2 to H7 is < 0.05, which reflects that the relationship of each of the GHRM practices (i.e. green recruitment and selection, green training and development, green performance management, green compensation management, green health and safety, green involvement, and relation) is highly significant with organizational performance. The regression test results of GHRM practices shows 10.9, 11.4, 6.8, 10.9, 10.9 and 25.5 % of variance respectively in the organizational performance ranges from ΔF=13.615 (being lowest) to ΔF=63.859 (being highest) where, p<0.005. The standardized beta values of all GHRM practices were also positive and significant which are presented in Table 4.

Table 4. Summary of regression analysis for direct research hypotheses

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Hyp** | **Variables** | **Organizational Performance** | | | | | | | |
| **β** | **T** | **R2** | **Adj R2** | **ΔR2** | **F** | **ΔF** | |
| 1 | Green Job analysis and design | 0.363\*\*\*\* | 5.325 | 0.132 | 0.127 | 0.132 | 28.355\*\*\*\* | 0.000\*\*\*\* | |
| 2 | Green Recruitment and Selection | 0.330\*\*\*\* | 5.325 | 0.109 | 0.104 | 0.109 | 22.913\*\*\*\* | 0.000\*\*\*\* | |
| 3 | Green Training and Development | 0.337\*\*\* | 4.902 | 0.114 | 0.109 | 0.114 | 24.026\*\*\*\* | 0.000\*\*\*\* | |
| 4 | Green Performance Management | 0.261\*\*\*\* | 3.690 | 0.068 | 0.063 | 0.068 | 13.615\*\*\*\* | 0.000\*\*\*\* | |
| 5 | Green Compensation Management | 0.329\*\*\*\* | 4.771 | 0.109 | 0.104 | 0.154 | 22.765\*\*\*\* | 0.000\*\*\*\* | |
| 6 | Green Health and Safety | 0.329\*\*\*\* | 4.771 | 0.109 | 0.104 | 0.251 | 63.859\*\*\*\* | 0.000\*\*\*\* | |
| 7 | Green Involvement and employee Relation | 0.416\*\*\*\* | 6.263 | 0.255 | 0.169 | 0.173 | 39.230\*\*\*\* | 0.000\*\*\*\* | |
| 8 | Big Data Acceptance | 0.481\*\*\*\* | 7.511 | 0.232 | 0.228 | 0.232 | 56.410\*\*\*\* | 0.000\*\*\*\* | |
| 9 | Big Data Adoption | 0.335\*\*\*\* | 4.861 | 0.112 | 0.107 | 0.112 | 23.630\*\*\*\* | 0.000\*\*\*\* | |
| 10. | Big Data Assimilation | 0.407\*\*\*\* | 6.100 | 0.166 | 0.161 | 0.166 | 37.209\*\*\*\* | 0.000\*\*\*\* | |
| \* p<0.05, \*\* p<0.01, \*\*\* p<0.005, \*\*\*\* p<0.001 | | | | | | | | |

Three hypotheses were tested using the hierarchical regression analysis, which is widely used to test moderating effects (Yuan & Chen, 2015). The big data acceptance (BDAC) significantly moderates the relationship between GHRM practices and organizational performance, as it explained 18.9% of the variance in organizational performance. Big data acceptance explained 28.7% of the variance in organizational performance, with a significant value of ΔF= 25.431 (p<0.001). Finally, the interaction term of GHRM and big data acceptance explained an additional 29.2% of the variance in organizational performance, with an insignificant value of ΔF= 1.256 (p>0.05). The results from Table 5 show that there is a continuous and significant improvement in the value of R2 in Model 1 (R2=0.189), Model 2 (R2=0.287), and Model 3 (R2=0.280), which validates big data acceptance as a moderator.

Big data adoption (BDAD) moderates the relationship between GHRM practices and organizational performance, since 18.9% variance was explained by GHRM practices. As evident from Table 5, big data adoption explained 24.3% of the variance in organizational, with a highly significant value of ΔF= 13.347 (p<0.001). Finally, the interaction term of GHRM practices and big data adoption explained 24.5% of the variance in organizational performance, with an insignificant value of ΔF= 0.342 (p>0.05). Table 5 shows that there is a continuous and significant increment in the value of R2 in Model 1 (R2=0.189), Model 2 (R2=0.243), and Model 3 (R2=0.245), which validates big data adoption as a moderator.

Big data assimilation (BDAS) moderates the relationship between GHRM practices and organizational performance as GHRM practices explained 18.9% of the variance in organizational performance with a significant value of ΔF= 43.631 (p<0.001). Big data assimilation explained 25.4% of the variance in organizational performance, with a significant value of ΔF=16.256 (p<0.001). Finally, the interaction term of GHRM and big data assimilation explained an additional 25.5% variance in organizational performance. The results from Table 5 show that there is a continuous and significant improvement in the value of R2 in Model 1 (R2=0.189), Model 2 (R2=0.254), and Model 3 (R2=0.255), which validates big data assimilation as a moderator (See Table 5).

Table 5: Summary of hierarchical regression analysis for moderation hypotheses

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable (s)** | **GHRM x BDAC** | | **GHRM x BDAD** | | **GHRM x BDAS** | |
| **β** | **t** | **β** | **t** | **β** | **t** |
| **Step 1: Independent** |  |  |  |  |  |  |
| Model 1 | 0.464\*\*\*\* | 6.605 | 0.464\*\*\*\* | 6.605 | 0.464\*\*\*\* | 6.605 |
| Model 2 | 0.284\*\*\*\* | 3.786 | 0.399\*\*\*\* | 5.681 | 0.346\*\*\*\* | 4.696 |
| Model 3 | -0.055 | 3.461 | 0.206 | 3.653 | 0.280 | 0.865 |
| **Step II – Moderator** |  |  |  |  |  |  |
| Model 2 | 0.342\*\*\*\* | 4.635 | 0.233\*\*\* | 0.612 | 0.278\*\*\*\* | 4.032 |
| Model 3 | 0.054 | 4.635 | .071 | 0.249 | 0.223 | 0.813 |
| **Step III: Interaction** |  |  |  |  |  |  |
| Model 3 | 0.092 | -1.908 | 0.050 | 0.585 | 0.017 | 0.208 |
| ***Value of R2:*** |  | |  | |  | |
| Model 1 | 0.189 | | 0.189 | | 0.189 | |
| Model 2 | 0.287 | | 0.243 | | 0.254 | |
| Model 3 | 0.292 | | 0.245 | | 0.255 | |
| ***Value of Adjusted R2:*** |  | |  | |  | |
| Model 1 | 0.185 | | 0.185 | | 0. 185 | |
| Model 2 | 0.279 | | 0.235 | | 0.246 | |
| Model 3 | 0.280 | | 0.233 | | 0.242 | |
| ***Value of F:*** |  | |  | |  | |
| Model 1 | 43.631\*\*\*\* | | 43.631\*\*\*\* | | 43.631\*\*\*\* | |
| Model 2 | 37.381\*\*\*\* | | 29.930\*\*\*\* | | 31.723\*\*\*\* | |
| Model 3 | 25.375\*\*\*\* | | 19.997\*\*\*\* | | 21.055\*\*\*\* | |
| \* p<0.05, \*\* p<0.01, \*\*\* p<0.005, \*\*\*\* p<0.001 | | | | | | |

5. Discussion

Drawing on resource-based theoretical insights, our empirical study has attempted to investigate the interplay of GHRM practices, big data analytics, and organizational performance. The results provide strong support for the first seven hypotheses, suggesting that each GHRM practice strongly influences organizational performance. This finding is congruent with existing literature wherein GHRM practices affect sustainable or environmental performance (Zaid et al., 2018; Kim et al. 2019; Obeidat et al., 2020; Wongleedee, 2020). The results are also consistent with the study of Mousa & Othman (2020), which identified the positive relationship of GHRM practices on an organization's sustainable performance, since our findings also affirm the significant and positive relationship between GHRM practices and organizational performance.

Among the first seven hypotheses, hypothesis H1, H2, H3, H5, and H6 are strongly supported, whereas H7 is mildly supported and H4 is the least supported. Our study inferred that green health and safety is the most influential GHRM practice followed by green involvement and relation, whereas green performance management is the least significant in determining organizational performance. In contrast, the existing literature has found ‘green recruitment’ as the most effective GHRM practice followed by ‘green training‘ whereas ‘green performance management and green compensation’ were the least effective GHRM practice in the healthcare sector of a developing country (Mousa & Othman, 2020).

Further, for hypothesis H8 to H10, we find that big data analytics moderates the relationship of GHRM and organizational performance, which is consistent with previous studies that big data analytics is positively associated with organizational performance and plays a vital role in enabling organizations to achieve competitive or superior performance (Gupta et al., 2020). In summary, the moderating effect big data analytics was observed on the interaction between GHRM practices and three big data analytics dimensions, i.e., big data acceptance, big data adoption, and big data assimilation and outcome variables (i.e. organizational performance). The findings reveal that GHRM practices integrated with big data analytics capabilities help in augmenting the organization's performance.

Congruent with the above findings, our results also supported the previous literature through validating each dimension of big data analytics’ moderating role. This study results are also consistent with the findings of Wang, Zhang, & Zhang (2020), who examined the role of big data analytics on the relationship between corporate social responsibility (CSR) and green supply chain management (GSM) practices. They found that big-data analytics capability intensifies the relationship between external CSR and firm performance. Furthermore, the researchers concluded that big data analytics positively moderated the relationship between external CSR (ECSR) and GSCM, i.e. (BDAC×ECSR; b = 0.29, p < 0.01), and there was a significant incremental variance (ΔR2 = 0.07), but GSCM was not moderated by big-data analytics capability.

Big data analytics was also examined as a mediator in the study Mishra et al. (2019), which confirms that IT and HR capabilities do not directly influence organizational performance but instead indirectly influence through the diffusion of big data analytics. Further, the study by Gupta et al. (2020) demonstrated a positive direct relationship between big data organizational capability (BDPA) and organizational performance. The result of the study indicated that all the p values were <0.05, which means that for 95% of the time, the dependent variables (i.e., operational performance, market performance, and financial performance) were positively influenced by the enablers (namely managerial skills and technical skills) of big data predictive analytics.

Finally, the results strongly supported that GHRM practices positively and significantly impact organizational performance. This is consistent with existing literature that GHRM positively affects environmental performance (Ren, Tang, & Jackson, 2020) and organizational and environmental performance (Obeidat et al., 2020). Lastly, our research adds a new dimension to the previous literature on organizational performance by Obeidat et al. (2020), which can be enhanced through leveraging green HRM practices to enable environmental and corporate performance. In this regard, our study extends into the downstream integrating relationship of big data analytics capabilities and utilizes strategic human resources. This integration complements technology adoption and catalyzes transformational practices into core capabilities within an organization, thus completing the whole value chain process to achieve organizational performance. This study is rooted in the resource-based view of Barney et al. (1991), which continuously encourages organizations to strengthen their technical (i.e. BDA capabilities) and human resource skill-sets to acquire and sustain a source of competitive advantage.

**6. Theoretical and practical implications**

This study advances the knowledge base through investigating the impact of each individual GHRM practice on organizational performance as the current literature mainly focuses on investigating the composite role of GHRM practices towards the performance of organizations. Moreover, organizational performance can be significantly enhanced through adoption of GHRM practices in the presence of big data analytics. This research study provides empirical evidence with the support of the resource-based view of strategy that efficient utilization and management of green resources (i.e. human resources) combined with effective implementation of big data analytics enhances organizational productivity and corresponding performance. The findings of this study support earlier literature suggesting the use of GHRM practices and big data analytics can significantly contribute to improved organizational performance (Gupta et al., 2020; Obeidat et al., 2020; Thirathon et al., 2017). Additionally, implementation of GHRM practices in organizations of developing countries (such as Pakistan and others) is still in its infancy; in such cases either the management function is reluctant to invest in environmental initiatives or is unaware of the benefits the organization and society can reap in the long run.

This study also suggests implications for managers, HR managers, executives, senior management, and decision-makers involved in implementation of GHRM practices to promote green behavior and enhance organizational performance. Employees' green skills and competencies should be developed through effective mechanisms and systems along with strengthening health and safety protocols. Therefore, senior management should prioritize incorporating GHRM practices with strategic business goals for improved organizational outcomes. Indeed, the moderating role of big data analytics contributes to a growing body of knowledge relevant to practitioners concerning the importance of effective and timely decision-making as well as the conservation of resources through adopting GHRM policies and practices. Moreover, this study acknowledges the existing literature through articulating that the availability and appropriate use of resources and big data analytics are critical for organizations to improve efficiency and achieve competitive advantage (Gupta et al., 2016). Nevertheless, senior management needs to focus more on the best use of big data analytics to support effective decisions at the right time. Further, middle management and HR managers need to ensure effective implementation of GHRM practices, and lower management should follow the guidelines and policies concerning big data analytics and GHRM practices to enhance productivity and performance of respective organizations.

7. Conclusions, limitations, and future research directions

This study investigated the moderating effect of big data analytics on the relationship between GHRM practices and organizational performance to address the critical gaps in the existing body of knowledge. The findings revealed that employees perceive green health and safety as the most effective practice to play a pivotal role in achieving organizational performance, which is in addition to implementation of big data analytics. This study significantly enhances the understanding and role of GHRM practices that substantially influence organizational performance combined with the use of big data analytics to maximize the benefits of GHRM and improve organizational efficiency. Therefore, organizations must be proactive in identifying and addressing the operational and managerial challenges in implementing big data analytics and GHRM practices. Moreover, this study can serve as guidance for implementation of GHRM in recruitment, training and development, performance management, compensation management, employee involvement, and relationship management and its integration with data-driven technologies to enable organizations to become more productive.

This explanatory research was cross-sectional in nature and a longitudinal or time-lagged study may be beneficial in the future to evaluate the GHRM practices and the impact of big data analytics. Similarly, this study collected data from different organizations of various industries, however, data collection from specific organizations and particular industries or sectors is another area of consideration for future research. Moreover, this study investigated the moderating effect of big data analytics, whereas its direct impact on organizational performance was not part of this research, which may be examined through future research with a greater sample size to ensure more generalizability of the results. Finally, this study employed regression analysis through SPSS software to test the research hypotheses, and future research may consider other analysis techniques including the SEM-based multivariate approach and PLS smart to generate more detailed results and corresponding insights.

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**Appendix – I:** Survey questions used for measurement of variables

**Green HRM Practices**

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| * My organization has integrated several environmental protection responsibilities in each position. |
| * My organization has included the green and social needs of the organization in the job description and specification. |
| * My organization utilizes team collaboration as a job design method for effectively achieving green targets. |
| * My organization has incorporated the environmental aspect as a task in the job description. |
| * My organization has incorporated environmental consciousness as a core competency in the competency model for talent. |
| * My organization considers green criteria for shortlisting of applicants. |
| * Our organization prefers hiring individuals who have environmental awareness. |
| * Our organization has incorporated "green aware" criteria in HR staffing policy. |
| * My organization practices the use of paperless recruitment and selection processes. |
| * My organization makes job incumbents acquainted with the greening initiatives of the organization. |
| * My organization inspires incumbents to participate in green interpersonal citizenship behavior. |
| * My organization has developed orientation programs presenting environmental protection initiatives of existing employees. |
| * My organization assesses whether the organization has the budget, time, and expertise for conducting green training. |
| * My organization assesses whether employees possess the necessary skills to master the content of the green training program. |
| * My organization assesses who needs training in environmental management. |
| * My organization uses environmental protection elements as the central themes of green training. |
| * My organization facilitates incumbents to grow and gain awareness in environmental management, green skills, and outlook. |
| * We design green training contents to enhance employee capabilities and awareness of environmental protection. |
| * My organization delivers environmental management training to improve employee awareness, skills, and know‐how in environmental management. |
| * My organization uses online and web‐based green training components and collaborative media. |
| * In my organization, job rotation in green tasks is a critical segment of the career development plans of managers. |
| * In my organization, the manager establishes green targets, objectives, and duties for each employee across an organization. |
| * In my organization, managers established goals to attain green targets incorporated in periodic evaluations. |
| * My organization uses green performance indicators in yearly performance evaluations. |
| * My organization uses green performance standards as a yardstick in the performance evaluation of the workforce at all levels. |
| * My organization keeps track of non‐compliance or not meeting green objectives. |
| * My organization identifies "Green Superstars who perform beyond the standards award prizes based on their green contributions. |
| * My organization rewards individuals for the accomplishments of green targets. |
| * My organization's compensation system recognizes and rewards contributions to environmental protection. |
| * My organization compensates for green skills acquisition and accomplishments by individuals. |
| * My organization provides financial or tax incentives to its employees for accomplishing green tasks. |
| * My organization appreciates the green initiatives of employees through publicity and public praise. |
| * My organization provides green workplace health and a safe environment for all. |
| * My organization takes green initiatives to decrease worker anxiety and sickness. |
| * My organization develops and implement strategies for the health and safety protection of the workforce. |
| * My organization has a strong progressive vision to direct the individuals' activities in environmental protection. |
| * My organization offers a shared culture of learning for green awareness, behavior, and suggestions. |
| * My organization use formal and informal communication channels to develop green values of employees |
| * My organization promotes a culture of feedback, green training, and communication among employees. |
| * My organization organize sessions to resolve problems related to the green environment |

**Big Data Analytics**

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| * Our organization use advanced analytical techniques (e.g., simulation, optimization, regression) to improve decision-making |
| * Our organization use multiple data sources to improve decision-making |
| * Our organization use data visualization techniques (e.g., dashboards) to assist users to decision-maker in understanding complex information |
| * Our organization use dashboards to help to display information to undertake cause analysis and continuous improvement |
| * Our organization use dashboard applications/information in the communication devices (e.g., smartphones, computers) of the humanitarian actors. |
| * You believe that embracing BDPA helps you enhance your job performance. |
| * You and your colleagues associate with the BDPA systems. |
| * You believe that an organizational and technical infrastructure exists to support the use of the BDPA. |
| * Big data is used as an essential tool in every department (volume). |
| * Big data is used for decision-making in your organization (diversity). |
| * Big data is used in the functional area of operation (depth). |
| * Big data is used in the functional area of management (depth). |

**Organizational Performance**

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| * The organization focuses on quality of Products or Services |
| * The organization encourages the development of new products or services |
| * The organization provides attraction to employees |
| * The organization can retain employees |
| * Organization focuses on client satisfaction |
| * Organization emphasis on healthy relationships between Senior management and employees |