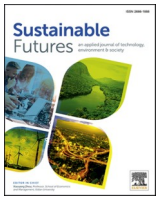
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Navigating the landscape through digital human resource management: An initiative to achieve sustainable practices

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ABSTRACT

The adoption of Digital Human Resource Management (DHRM) is increasing exponentially in the present market landscape; organizations are curious to digitalize human resource practices and enhance organizational performance. The purpose of the presented research is to assess various factors impacting DHRM adoption. The presented study is grounded in social exchange theory and dynamic capability theory. The survey instrument was developed using a literature review. Data from 269 respondents was collected, and Structural Equation Modeling was used to analyze the data. The research investigated the role of DHRM in achieving organizational performance. Furthermore, the role of sustainable Human Resource Practices (SHRP) is examined as a mediating variable. Also, the impact of Employee Engagement is analyzed on organizational performance. Moreover, the role of Management Support is analyzed to assess the relationship between DHRM, SHRP, and Employee Engagement (EENG). The result indicates that external environmental factors significantly impact DHRM practices. Also, SHRP partially mediates the association between DHRM and EENG. DHRM enables professionals to analyze real-time data, allowing managers to make informed decisions. In today's globalized scenario, the emergence of DHRM concept helps to automate and streamline Human Resource (HR) tasks, including performance management, recruitment, training, and appraisal, which eventually help to attain a sustainable competitive advantage. As found in existing literature, the DHRM domain is novel, and more empirical studies must investigate crucial aspects affecting DHRM adoption. Therefore, this study focuses on bridging the identified gaps.

1. Introduction

Industrial revolutions have brought a significant change in the way of doing industrial work [1,2]. Several studies discussed it specifically in the last few decades ([3] and [4]). Improving workforce productivity is a major concern in today's market landscape [5]. Scholarly literature [6] discussed that digital technologies, including artificial intelligence (AI) and machine learning (ML), help to overcome these challenges and enhance employee attitude, engagement, and performance. Moreover, in a rapidly changing globalized scenario, digital technologies profoundly impact human resource management practices. However, its adoption could be more convenient, so the organization must be updated with highly advanced tools [7–9]. In line with the mentioned perspectives, as per the report by Deloitte [10], the human resources domain is undergoing drastic change, and digital technologies will help enhance sustainable employee performance. Moreover, Sani et al. [4] examined the impact of digital onboarding on employee outcomes and discussed both positive and negative aspects. Moreover, Mosca [11] added that DHRM helps to reduce the time to perform activities and enhance efficiency. Also, Petrilli et al. [12] highlighted the importance

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of digital onboarding in the competitive marketplace.

Garcia-Arroyo & Osca [13] termed big data as a valuable resource for organizations. In line with this, Sousa et al. [14] and Angrave et al. [15] added that big data analytics helps in effective decision-making through real-time data, information, and predictive analytics. Also, it helps in talent acquisition and leadership development. Furthermore, External environmental forces like government rules and regulations [2], cybersecurity norms [6], economic feasibility [16], and industry competition [17] have a pivotal role in driving the organizations towards DHRM adoption.

Laumer et al. [18] discussed the significance of the Applicant Tracking System (ATS) in reducing cycle time of recruitment processes, thus making the jobs of HR professionals easy. Nevertheless, adopting DHRM is subject to various challenges; Mosca [11] stated that the lack of comprehensive skill sets, and top management commitment pose challenges. On the same lines, Pantelidis [19] discussed cyber-security threats by extensively relying on digital technologies. In line with this, Tambe et al. [20] assessed the roadblocks to implementing AI in human resource management (HRM) as smaller data sets and ethical concerns. Chowdhury et al. [21] highlighted another concern about using AI as reduced transparency and interpretability. Therefore, adopting effective management strategies to tackle the challenges and adopt DHRM relatively quickly is essential [22].

Vereycken et al. [23] analyzed HR practices in the context of Industry 4.0 and found a highly positive association. However, the association with job complexity and skill requirements could be more robust. Also, Verma et al. [6] analyzed HR digitalization's enablers as change management practices, continuous learning, e-learning, digital talent possession, etc. Usually, it is seen that employees are reluctant to change to adopt advanced technologies [24]. Therefore, organizations must organize training and development programs on updated technologies so employees can become acquainted and attain the required skill sets. El-Kot et al. [25] discussed similar findings and concluded that DHRM enhances employee productivity and performance. Dery et al. [26] mentioned that a digital workplace is the precursor to enhanced innovation capabilities. A study by Popescu et al. [27] analyzed the fact that the government must invest in skill development initiatives and develop required legislation and regulatory frameworks.

Moreover, Nicolas-Agustin et al. [17] analyzed that effective HR practices help achieve digital transformation goals relatively quickly. Also, they further mentioned that strategic alignment is highly crucial, and HR practices mediate its relationship with digital transformation. Also, Fenech et al. [28] mentioned that DHRM adoption helps in enhanced communication, increased sustainability, and better employee morale and satisfaction. Moreover, on similar lines, Trocin et al. [29] mentioned that by AI tools, job advertisements can be shown to the correct set of candidates so that they can be interviewed, and the right talent can be acquired. Additionally, the ranking of candidates can be done without human intervention. Furthermore, DHRM facilitates unbiased performance and compensation management, helping build a fair, sustainable and transparent system [30].

With globalization, the amount of data is increasing at an exponential rate. Since traditional-based HR systems cannot process large amounts of data, the need for DHRM is significant [31]. Moreover, the connection between DHRM and Sustainable Human Resource Practices (SHRP) is a grey area of research and needs investigation. The presented research is carried out in an emerging economy, India, because it is a fast-growing economy with a large and diverse workforce. Handling such a huge workforce is cumbersome in the vacillated market environment. The presented research analyzed various constructs, including Management Support (MS), Employee Engagement (EENG), SHRP, DHRM, Organizational Performance (OP), and External Environment (EE) factors. In the presented study, the construct items were developed using social exchange theory and dynamic capability theory. As per Blau [32], social exchanges can be referred to as 'volunteer activities' that can be started by favorable treatment to the workforce with the expectation of reciprocal action. Another study by Yin [33] discussed that the higher the level of justice in an organization, the higher is the job engagement. Moreover, as per the dynamic capability theory (DCT); organizations must revamp themselves as per changing dynamic market scenario [34]. Therefore, top management officials must show curiosity to adopt digital transformation of human resource (HR) practices and organize training and educational programs to make the employees comfortable. Literature review reveals that limited studies are available in the context of DHRM, SHRP and organizational performance.

Keeping in view the perspectives mentioned above, the research objectives are framed as follows:

- To discuss how external environmental factors impact the adoption of DHRM in organizations.
- To examine the role of SHRP as mediating variable in association between DHRM and EENG.
- To examine how management support influences the relationship between DHRM, SHRP, and EENG.

To achieve the above-stated research objectives, a questionnaire was prepared using literature review, containing thirty-two measuring scale items from various constructs including DHRM, EENG, OP, MS, SHRP, EE. The data was collected from 269 respondents and analyzed using Structural Equation Modeling (SEM). SPSS-AMOS was used for data analysis. Moreover, Process-Macro was also used for examining the role of management support in the relationship between DHRM, SHRP, and EENG. The remainder of the research paper is structured as follows: Section 2 covers the theoretical foundations and the development of the hypotheses. Section 3 illustrates the development of the survey instrument and data-gathering procedures. The following section discusses the data analysis and outcomes. Discussion and implications are presented in the following section. The last section concludes the paper and identifies potential areas for future research.

2. Theoretical background and hypotheses development

The rise of DHRM is attributed to disruptive technologies that have revolutionized traditional HR practices (Gjika & Pano, [35]; [36]). Advanced technologies have automated and digitalized HR processes, improving efficiency, accuracy, and cost-effectiveness [37]. In traditional work, employees were supposed to do full-time work; loyalty and tenure were significant metrics [2]. Also, the tasks were usually repetitive with less innovation and creativity. However, in a dynamic marketplace, there is need for advanced skill sets and a growth mindset, and people must unlearn and relearn continuously.

Sousa et al. [14] discussed nine areas of human resources impacted by extensive data analytics capabilities like workforce assessment, human resource management, analysis of attrition and retention, knowledge management, HR development, information management, effective planning, formulation of business strategy and management information systems etc. Mosca [11] assessed technological, organizational, and personal factors affecting DHRM adoption. Moreover, Halid et al. [8] stated that DHRM helps to enhance organizational performance through usage of digital technologies which are supported by information technologies. Mahasumran et al. [38] assessed that DHRM adoption enhances employee engagement and participation.

DHRM positively impacts sustainability aspects and employee performance [39]. Moreover, DHRM enables remote work using digital technologies and results in sustainable business performance [40]. However, the initial cost of adopting digital technologies may be higher, but long-term benefits are very appealing [24].

The association between DHRM, EENG and sustainability needs investigation. Moreover, Srivastava & Singh [41] discussed the role of psychological ownership as a mediating variable among inclusive leadership and Organizational Citizenship Behavior (OCB). Ng et al. [42] discussed similar findings and stated that job satisfaction is

positively associated with OCB. Also, Setyaningrum & Muafi [40] discussed that the top management is quite often found busy in day-to-day managerial activities and needs to pay attention to adopting advanced technologies. Furthermore, Uddin et al. [43] discussed three significant features of employee engagement: working optimistically, staying focused, and having a solid commitment to achieving organizational goals and objectives.

Countries across the world are making strong efforts to adopt DHRM successfully. The government of Singapore initiated the “Smart Nation” concept, where 99 % of the government services will be in digital mode. As per a Southeast Asea survey [44], 96 % of HR professionals agree that their role is transforming to highly strategic and innovative to handle HR practices. The USA also started the initiative towards advancing work capabilities and responding quickly to the changing markets. To serve the citizens better, the UK government also initiated the "Digital Strategy" program [45]. Like ways, the Indian government is putting high efforts into enhancing IT facilities, with a compound annual growth rate (CAGR) >15 % and forecast to be worth rupees $394 billion by 2027 [46]. Also, the "Digital Transformation Agency" of the Australian government declared Vision 2025 as a step towards adopting digital practices.

Moreover, the Canadian Government is promoting Digital technologies through the campaign “Digital Ambition," by which it plans to become a world leader [47]. Moreover, "Digital Skills for Youth" is also launched to meet these objectives [48]. Adopting DHRM can result in Good Health and well-being (SDG-3) by providing conducive work environments, Quality Learning (SDG-4) through customized training and educational programs, Gender Equality (SDG-5) by conducting a fair and transparent recruitment process, and Decent Work and Economic Growth (SDG-8) by providing advanced technology facilities.

2.1. Underpinning theories

The underpinning theories are Social Exchange Theory (SCT) and Dynamic Capability Theory (DCT) and are discussed as follows:

2.1.1. Social Exchange Theory (SCT)

Homans [49] introduced this theory, which explains human behavior in society. Moreover, the theory explains that all human players are indulged in exchanging tangible and intangible possessions and rewards. Also, SCT underlines the perspective for effective exchanges between two parties [50]. This theory also highlights the interdependent interactions using which a person feels obliged to reciprocate in the way they were treated. Management must support employees in adopting advanced technologies for successful DHRM adoption [51].

Moreover, training and development programs, recognition and reward policies help to boost employee morale [52]. These initiatives facilitate the employees to reciprocate the same positive actions, i.e., more work engagement and optimistic thinking to achieve the organizational vision and mission [53]. Moreover, seamless integration is subjected to various challenges; collaboration among stakeholders is required for successful DHRM adoption [54]. Digital technologies facilitate transparency and traceability, therefore help in building trust. DHRM interfaces must be reliable, compatible, and user-friendly so employees feel comfortable using them [31].

2.1.2. Dynamic Capability Theory (DCT)

Teece et al. [55] initiated this theory to address the competition resulting from technological changes. Organizations must have dynamic capabilities to survive in today’s rapidly changing business landscape. Static capabilities differ from dynamic capabilities; the former deals with ordinary scheduled activities, while the latter explains organization’s capabilities to tackle cutthroat competition in globalized markets [56]. DCT emphasizes the organization’s capabilities through capacity planning and resource adjustments [57]. Dynamic capabilities also represent organizations’ capabilities to revamp internal and external processes and react promptly to changing market conditions [58]. Therefore, dynamic capabilities facilitate the organization’s competitive advantage and the adoption of technological innovations. Another definition of dynamic capability by Helfat [59] defined it as an organization’s capability to create, innovate, and restructure to respond to the market in a minimum period. Therefore, the organization must focus on dynamic capabilities and stay updated to handle market complexities. Moreover, digital human resource management helps to enhance employee well-being and performance.

2.2. Hypotheses development

The hypotheses development is discussed as follows:

2.2.1. EE and DHRM

In the current VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) environment, external environment profoundly affects DHRM adoption [60]. Bennett & Lemoine [61] discussed that strategic planning is essential to overcome DHRM adoption challenges and enhance organizational performance. Moreover, the authors used dynamic capability theory to assess the significance of people management in analyzing organizations’ competitiveness and achieving sustainable practices in Human Resource Management (HRM). Government rules and regulations also play a crucial role in DHRM adoption; the policies, rules, and regulations must be conducive [2]. Moreover, Verma et al. [6] & Nazarian et al. [62] discussed that increasing competition urges organizations to adopt the latest tools and techniques to survive in a competitive marketplace. Also, Ergen [63] mentioned the importance of data security so that stakeholders’ trust and interest can be built up while adopting DHRM. Although the long-term benefits of DHRM are extraordinary, as the initial investment is quite huge, this may resist its adoption in small and medium-scale industries [16]. Furthermore, DHRM results in enhanced performance, and employee engagement, facilitates the employees to handle increased work pressure and demands. Moreover, dynamic capabilities facilitate the organization to develop conjectures about complex environments, helping managers make critical decisions [64]. So, we hypothesize that:

H1. *External Environment factors have a relationship with DHRM adoption.*

2.2.2. DHRM, SHRP, and EENG

DHRM adoption impacts EENG [6] and SHRP [65]. EENG can be measured by employee feelings such as motivation, commitment, passion, satisfaction, etc. [66]. Engaged and motivated employees are equipped with a positive mindset, resulting in enhanced work satisfaction. Nienaber & Martins [67] mentioned that employee engagement is above work engagement; the former implies passionately and diligently immersing oneself physically, cognitively, and emotionally aimed toward maximizing organizational performance. Shuck et al. [68] discussed similar findings and developed employee engagement scale.

Prange et al. [69] discussed acquisition-based and innovation-based dynamic capabilities to investigate DHL, a logistics company’s transition processes and concluded its vital role. Moreover, the authors analyzed green hiring, training, and education as the critical constructs of green practices. Also, Delecraz et al. [70] highlighted that DHRM facilitates an unbiased recruitment process, thereby helping in enhanced transparency. Chillakuri and Attili [71] discussed that blockchain in HRM practices increases traceability, transparency, and sustainability. Moreover, the authors mentioned that as HR managers are skeptical about sharing data and information because of susceptibility to cyberattacks, blockchain applications can overcome this issue. Abu-Salih et al. [72] discussed the significance of social, mobile, analytics, and cloud (SMAC) in facilitating response HR practices. Further, Budhwar et al. [73] analyzed AI applications in HRM, including planning, recruitment

and selection, compensation management, etc. Also, the positive outcomes were discussed as enhanced performance, satisfaction, efficiency, and service quality. Also, Garg et al. [74] discussed the application of AI and ML in recruitment and performance management.

Zaid et al. [65] discussed that green HRM significantly influences various sustainability dimensions, i.e., social, economic, and environmental. Also, ML applications can analyze employee engagement by analyzing employee data using various approaches like text-mining [74]. Moreover, the decisions taken by DHRM tools are fast and accurate as the system can analyze significant amounts of data far beyond human capacity [73]. DHRM helps automate daily routine activities, enabling employees to invest their time in creative and innovative tasks [6]. Also, DHRM facilitates the organization to monitor real-time employee engagement and organizational performance rather than measuring it annually [66]. Moreover, DHRM facilitates a digital workforce, a digital workplace, and a sustainable culture [2,75]. Also, DHRM streamlines HR operations, boosts employee morale, and enables HR professionals to make data-driven decisions [6]. The fundamental dimensions of EENG are organizational strategy, organizational commitment, and team commitment [67]. On the other hand, disengaged employees cause a vast productivity loss to the organizations. Therefore, we hypothesize that:

H2. *DHRM have a relationship with Employee Engagement (EENG)*

H3. *The relationship between DHRM and EENG is mediated by SHRP.*

2.2.3. DHRM, SHRP, MS, EENG

Digitalizing HR practices makes the work simple and convenient, thereby enhances efficiency [6]. Also, Dihan et al. [76] stated that DHRM helps to strengthen work engagement, meet high job demands, thereby helps to maintain work-life balance and enhance well-being of employees. Moreover, top management must provide the required resources, infrastructure, and sufficient funds to adopt digital technologies smoothly [51]. Furthermore, management support can enhance employee morale, significantly impacting generations of creative and innovative ideas. Also, it is imperative that top management must have proper vision and mission towards adopting digital HR practices [2]. Anwar et al. [77] analyzed role of green human resource practices as developing green competencies, enhancing green motivation, and employee engagement. All these practices significantly impact employee engagement and sustainable HR practices. Moreover, Cetindamar et al. [78] analyzed the significance of digital literacy in adopting the digital revolution, and the role of cognitive abilities is found significant. Furthermore, a study by Gupta et al. [79] proposed a dynamic capability view and investigated the vital role of management support towards digital transformations. Therefore, we hypothesize that:

H4. *MS influences the relationship between DHRM, SHRP, and EENG.*

2.2.4. EENG and OP

The literature review reveals that EENG has a positive association with OP. Gede and Huluka [80] conducted a study in Ethiopian universities and analyzed significant positive associations between EENG and OP using qualitative and quantitative measures. Another study by Schneider et al. [81] highlighted that EENG positively impacts work engagement, ultimately resulting in higher OP. Moreover, the authors discussed that EENG positively results in financial and customer gains. Similarly, Liu et al. [82] assessed the impact of employee engagement on innovative behavior, which in turn helps to enhance OP. Also, rewards and recognition policies, distributive and procedural justice are discussed as the key factors impacting the EENG. Moreover, Jangbahadur et al. [83] discussed the role of AI-enabled HR practices in effective EENG and sustainable OP. Also, the authors mentioned that more empirical evidence is needed to prove its relationship. Therefore, we hypothesize that:

H5. *EENG has a relationship with Organizational Performance (OP)*

Looking at all these perspectives, the conceptual model is revealed in Fig. 1 and Table 1 shows items of different constructs.

3. Research methodology

The research methodology is discussed as follows:

3.1. Development of survey instrument, data collection

In this research study, a survey instrument was developed using extensive literature. This study used a five-point Likert scale (one implies highly disagree and five implies strongly agree) to collect the responses, which is used in majority of the research studies [94]. A structured questionnaire was constructed and circulated to respondents with a formal cover letter indicating the aim of the research study. After explaining the research objectives to the targeted enterprises, the researchers sought respondents' consent to participate. Relevant explanations and specific examples in context of proposed research model were placed at the beginning of the questionnaire for a better understanding of the respondents. The data was collected from various industry sectors such as electronics, automobiles, healthcare, and travel and tourism. The questionnaire was bifurcated into two segments. The first segment asked respondents to provide information about the enterprise and demographic information. Including the respondents' positions was intended to ensure they had access to the necessary information and experience to be a respondent in our study. The second segment of the questionnaire intended to collect data related to questionnaire items about key aspects of research study.

Since collecting questionnaire data is cumbersome, precautions and adequate measures were adopted to collect the responses. As for entering the organization, prior approvals or contacts were required. Therefore, experts contacted in the initial stage were asked to give referral letters to proceed with data collection. Furthermore, heads of management associations of different states were also contacted to get the details of organizations curious to adopt DHRM. Moreover, the selection of experts after entering the organization was based on a simple random sampling technique; therefore, every sampling unit had an equivalent chance of being chosen, and randomness in data was generated. All the HR experts had sound domain knowledge of the HR domain, its various functions, and DHRM practices and had substantial years of work experience. The minimum qualification was graduation. Overall, 269 responses were collected. Based on gender, there were 127 males (47.21 %) and 142 females (52.79 %). Moreover, based on professional qualification, 106 were graduates (39.41 %), and 163 were postgraduates (60.59 %). For computing sample size, we used Yamane [95] formula and considered sample size found adequate.

$$n = \frac{N}{1 + N(e^2)} \tag{1}$$

where n, N, e *indicates sample size, population size and precision level*

3.2. Non-Response bias

As cross-sectional data was used in this study, we understood that the respondent's data can lead to inaccurate results. To handle this perplexity, we performed a *t*-test as per standard reference protocols suggested by Armstrong and Overton [96]. It was carried out in a two-step procedure adopted by Wamba et al. [97]. In step-1, performance analysis of the responding organization's type was evaluated and compared with the corresponding organization median value in that domain.

The statistical test reveals $p = 0.51$ among sample organizations and the organization's median value. Also, in the second step, the collected data was bifurcated into seventy timely and seventy late respondents. The findings indicate no statistical difference ($p = 0.361$) between

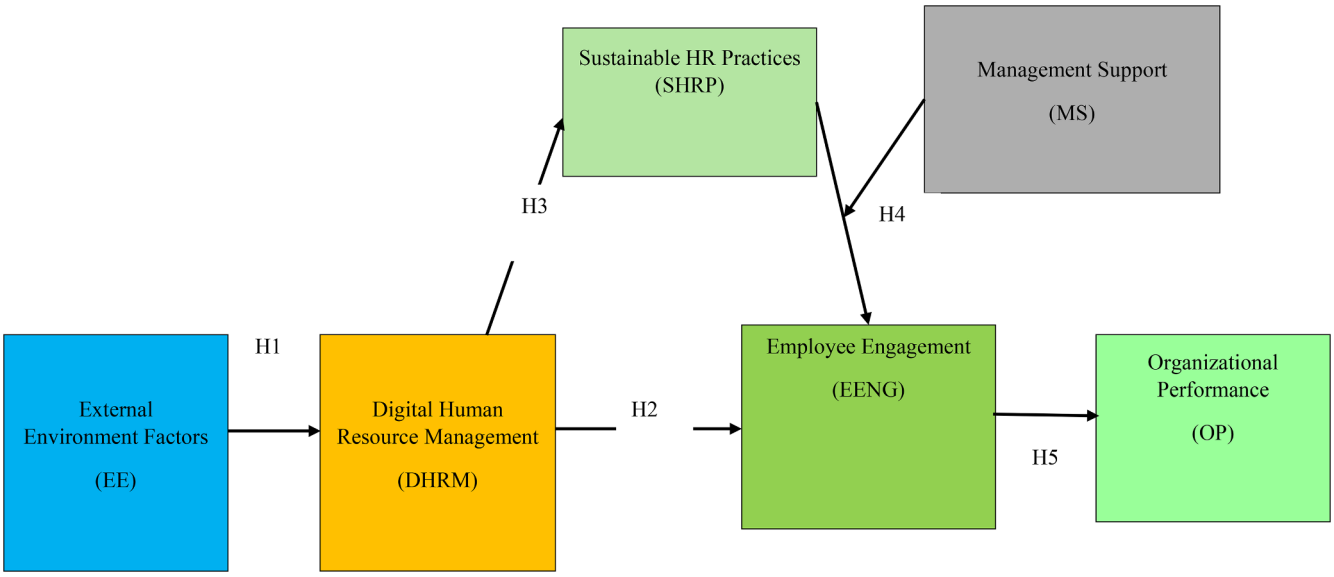


Fig. 1. Conceptual model.

timely and late respondents. These results indicate that the results computed were free from non-response bias.

4. Analysis and results

The Confirmatory Factor Analysis (CFA) was executed to validate the model's appropriateness. The results indicated that the model fit parameters were adequate and satisfactory, with values such as CMIN/DF=1.788, GFI=0.846, AGFI=0.818, TLI=0.933, CFI=0.940, and RMSEA=0.05 being indicative of the same. The standardized factor loadings, Average Variance Extracted (AVE) and Composite Reliability (CR) values are displayed in Table 2, with all factor loadings being >0.5. Additionally, both the AVE and CR values were found to be acceptable (AVE > 0.5 and CR > 0.7) [98]. The model's validity was further established by computing the discriminant validity; the outcomes are displayed in Table 3. The discriminant validity was determined by evaluating the correlation values among paired constructs and comparing against each construct's square root value of the AVE [99].

4.1. Common Method Bias (CMB)

The survey method is more prone to CMB [100]. Therefore, because of indicators, issues like consistency motifs and tendency for social desirability result in variation [97,101]. Moreover, Mackenzie & Podsakoff [102] identified various factors that contribute to respondents' disability to provide accurate answers. These include (a) low verbal ability or education level, (b) limited experience with the topic being surveyed, (c) complex or abstract questions, (d) unclear or ambiguous questions, (e) double-barreled questions that ask about multiple topics at once, (f) questions that require recalling past events, and (g) the mode of question administration, such as via telephone versus print or web. In the current study, adequate attention has been given to preventing all sources of CMB.

We tried to lessen the Common Method Variance (CMV) in our analysis. Firstly, as our respondents had sufficient knowledge of adopting digital technologies in human resources management, it indicates lower chances of CMV. Statistical assessments further confirmed the same. In our research analysis, the correlation among constructs was found to be <0.4, which is acceptable, maximum value being 0.9, as Srivastava and Singh [41] suggested. Moreover, the Variance Inflation Factor (VIF) is computed to be lower than three, which signifies the absence of multi-collinearity.

We further applied the Marker Variable Technique by considering one extra variable besides the other constructs used in the study, as Craighead et al. [103] recommended. The findings of the initial model and final model (with the introduction of the marker variable) were compared. The lower values of latent variable correlation coefficients indicate the absence of CMVs [97]. Moreover, we validated our findings with qualitative data and found matched results.

Another approach, Harman's Single Factor Test (HSFT) was used to assess CMB. The primary objective of using this technique is to check if a single underlying factor, usually called the "common method factor," examines the association among measured variables. Our results show that a particular factor does not explain a significant portion of the variance, indicating CMB's absence [97]. To further ensure the absence of CMB, this test was used in conjunction with the Common Latent Factor test, and the results were found acceptable.

4.2. Path analysis

Structural Equation Modeling (SEM) was done with the help of AMOS 26. The structural model parameters were computed as CMIN/DF= 1.835, GFI=0.899, TLI=0.949, IFI=0.956, and RMSEA=0.05. The results reveal that all parameters are satisfactory [4]. The external environment factors construct was found to have a positive association with DHRM adoption, which further impacts sustainable HR practices and EENG, as shown in Table 4.

Table 5 shows the mediation result of SHRP in analyzing the relationship between DHRM adoption and EENG. Mediation analysis was done using SPSS, PROCESS macro. It is observed that both direct and indirect paths are significant. As per Kenny's [104] model, partial mediation is the case. Organizations adopting DHRM systems can improve the ability to attract, retain, and develop employees, increasing employee engagement. Engaged employees are usually found more efficient, innovative, and committed.

Table 6 shows the results of the mediated moderation role of MS. As shown, MS moderates the relationship between SHRP and EENG. Moreover, the results reveal that management support influences the strength and direction of the relationship among DHRM, SHRP and EENG. If management is fully committed, this leads to improved EENG as shown in Fig. 2.

Table 1
Construct items.

Construct	Description of Items	References
Digital Human Resource Management (DHRM)	DHRM helps to automate HR processes	Lengnick-Hall et al. [22]; Fenech et al. [28]; Thite [2]
	Seamless integration in HR processes helps to take informed decisions	Vereycken et al. [23]; Thite [2]
	DHRM enhances communication among stakeholders	Zahoor et al. [84]; Thite [2]
	DHRM tools results in fair recruitment process	Fenech et al. [28]; Meijerink et al. [85]; Thite [2]
	DHRM facilitates remote work and virtual team management by quick access to data and information	Mahasumran et al. [38]; Thite [2]; Dabić et al. [86]
Management Support (MS)	Active involvement of senior management helps in the adoption of digital HR practices	Prieto-Pastor & Martin-Perez [51]
	Management must have comprehensive understanding of benefits of digital HR initiatives	Morton et al. [87]; Fenech et al. [28]
	Management provides adequate resources, including budget and infrastructure to support digital HR initiatives	Prieto-Pastor & Martin-Perez [51]; Zahoor et al. [84]
	Management provides training and development opportunities to advance digital HR skills	Fenech et al. [28]; Mahasumran et al. [38]; Nankervis et al. [1]
	Management has clear vison and mission to promote digital HR practices	Thite [2]
External Environment (EE) Factors	Government laws and regulations impact the adoption of DHRM practices	Thite [2]; Dabić et al. [86]
	Industry competition drives the need for DHRM and stay competitive	Verma et al. [6]
	Workforce demands to shape the implementation of DHRM solutions	Morton et al. [87]; Fenech et al. [28]
	Cost effective tools and techniques are required for adopting DHRM practices	Trujillo-Gallego et al. [88]
	Information security norms have crucial role in the adoption of DHRM practices	Verma et al. [6]
Sustainable HR Practices (SHRP)	Rewards and incentive policies are irrespective of racial discrimination	Diaz-Carrion et al. [89]
	Customized training for each employee	
	Develop rigorous employee development plan	
	Systematic and periodic procedure to provide feedback to employees	
	Unbiased performance appraisal system	
	Employee autonomy	
	Increased occupational health and safety aspects	
Employee Engagement (EENG)	Positive, and fulfilling working state through DHRM, thereby helping to develop knowledge and skillsets	Shuck & Reio [90]; Trujillo-Gallego et al. [88]
	Intellectual absorption using DHRM tools	Shuck et al. [68] ; Cooke et al. [91]; Nicolas-Agustin et al. [17]
	Effective utilization of mental energy resulting in job satisfaction	Shuck et al. [68] ; Gupta et al. [92] ; Trujillo-Gallego et al. [88]
	Behavioral engagement leading to effective decision-making, enhances collaboration among stakeholders	Shuck et al. [68] ; Cetindamar et al. [78]; Trujillo-Gallego et al. [88]
Organizational Performance (OP)	Sales and market share	Katou et al. [93]; Liu et al. [82]
	Optimize resources to achieve efficiency	
	Capacity development to achieve prospective opportunities and overcoming challenges	
	Satisfaction of customers	
	Innovative Products and Processes	
	Increased quality products and services	

Table 2
Convergent validity.

S. No.	Construct Items	Notation	Loading	AVE	CR
1.	DHRM	DHRM1	0.989	0.609	0.884
2.		DHRM2	0.674		
3.		DHRM3	0.758		
4.		DHRM4	0.750		
5.		DHRM5	0.691		
6.	SHRP	SHRP1	0.863	0.664	0.932
7.		SHRP2	0.881		
8.		SHRP3	0.912		
9.		SHRP4	0.734		
10.		SHRP5	0.829		
11.		SHRP6	0.722		
12.		SHRP7	0.743		
13.	EENG	EENG1	0.620	0.643	0.873
14.		EENG2	0.617		
15.		EENG3	0.915		
16.		EENG4	0.985		
17.	EE	EE1	0.877	0.697	0.918
18.		EE2	0.953		
19.		EE3	0.716		
20.		EE4	0.616		
21.		EE5	0.959		
22.	MS	MS1	0.947	0.647	0.900
23.		MS2	0.686		
24.		MS3	0.864		
25.		MS4	0.784		
26.		MS5	0.711		
27.	OP	OP1	0.694	0.650	0.916
28.		OP2	0.661		
29.		OP3	0.819		
30.		OP4	0.843		
31.		OP5	0.788		
32.		OP6	0.989		

5. Results and discussion

The findings of our study support H1, i.e., External environment (EE) factors have a positive impact on DHRM adoption ($\beta = 0.560$, $p = 0.038$) (Table 4). Disruptive technologies have impacted every sphere of business management. Moreover, external environment forces primarily include the VUCA environment aspects. Extensive competition urged organizations to work hard and adopt technological innovations. Our findings conform to Verma et al. [6], who emphasized the advantages of integrating digital tools with HRM practices. As the market is highly dynamic and volatile, organizations must keep pace with the evolving environment, including technological developments. DHRM can be vital

Table 3
Discriminant validity.

Construct	AVE	CR	DHRM	EE	SHRP	EENG	OP	MS
DHRM	0.609	0.884	**0.780**					
EE	0.697	0.918	0.336	**0.834**				
SHRP	0.664	0.932	0.200	0.231	**0.814**			
EENG	0.643	0.873	0.246	0.285	0.159	**0.802**		
OP	0.650	0.916	0.109	0.090	0.100	0.041	**0.806**	
MS	0.647	0.900	0.165	0.249	0.339	0.131	0.071	**0.804**

Table 4
Hypothesis testing results.

Hypothesis	Description	Standardized Beta	p value	Result
H1	EE DHRM	0.560	0.038	Supported
H2	DHRM EENG	0.170	0.005	Supported
H5	EENG OP	0.215	0.001	Supported

Table 5
Mediation results of SHRP among DHRM & EENG (Direct and Indirect Effect), Hypothesis H3.

Direct Effect						Result
Effect	**SE**	**T**	**P**	**LLCI**	**ULCI**	Partial Mediation
0.2927	0.0486	6.022	0.001	0.1974	0.3879	
Indirect Effect						
Effect	**SE**	**LLCI**		**ULCI**		
0.2615	0.0367	0.1896		0.3334		

Table 6
Results of role of MS among DHRM, SHRP and EENG, H4.

constant	Effects	SE	LLCI	ULCI
DHRM	0.1684	0.0104	0.1480	0.1888
SHRP	0.2187	0.0487	0.1233	0.3141
MS	0.1926	0.0314	0.1310	0.2542
INT_1	0.1825	0.0215	0.1404	0.2246

in assisting organizations to change, handle unpredictability, and simplify HR systems by providing real-time data and analytics and automating HR processes. Moreover, DHRM enables organizations to be more agile, productive, and flexible, to sustain in the competitive marketplace.

H2, the positive association among DHRM and EENG is supported ($\beta = 0.170$, $p = 0.005$). It implies that DHRM adoption gives a competitive edge to organizations, resulting in the efficacy of HR functions. DHRM directly influences employee engagement by making work simpler, quicker, and more transparent. Similar findings were reported by Varadaraj and Waldi [105], who emphasized that adopting DHRM practices results in a more efficient system. Adopting DHRM practices saves time which can be used by corporate professionals productively in innovative and creative tasks. Similar findings were discussed by Zhang & Chen [106]. Moreover, our study findings indicate that applications of digital technologies in HR management can enhance organizational performance through various means. These include streamlining HR processes, improving data management, facilitating effective communication and collaboration across departments, customized training, and providing employees with a self-service portal for accessing HR information. Therefore, DHRM can increase productivity, enhance employee satisfaction, improve decision-making, and reduce employee turnover. DHRM also facilitates organizations to work in compliance with government rules and regulations and provides data-driven insights for effective talent management strategies.

Hypothesis H3 shows mediation analysis results, as shown in Table 5, revealing partial mediation of SHRP among DHRM and EENG. The results aligned with Trujillo-Gallego et al. [88]. Also, the authors highlighted the importance of digital transformations in the human resource

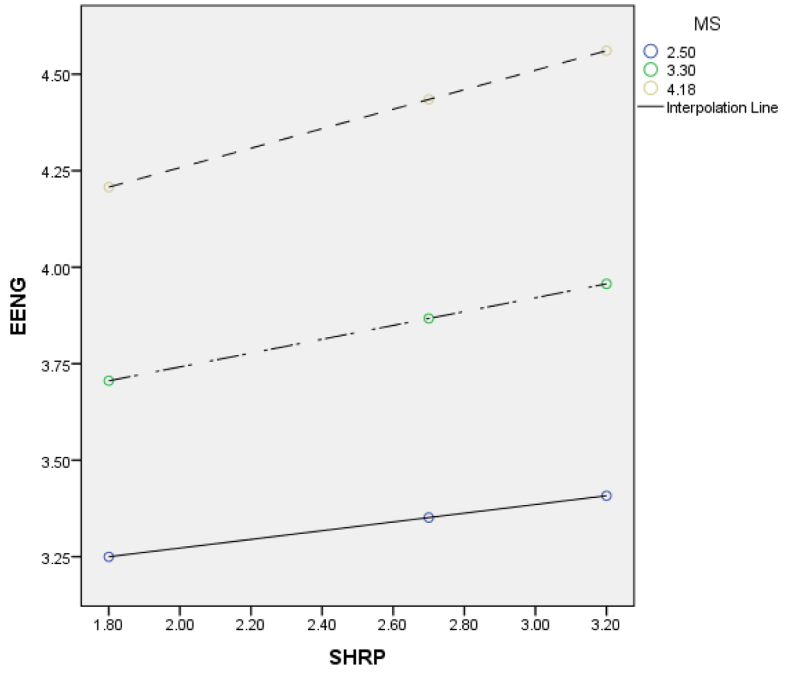


Fig. 2. Moderating role of Management Support on SHRP-EENG relationship.

domain and examined its strong relationship with achieving sustainable practices. Also, Kambur & Yildirim [107] further highlighted that industries must continually enhance their organizational capabilities and policies, particularly regarding technological innovations. DHRM can be facilitated by enablers such as digital infrastructure, skill enhancements, and creativity development. Similar results were reported by Al-kharabsheh et al. [108]. Implementing DHRM practices, such as self-service portals, helps in efficient HR processes, improves communication and collaboration between HR and other departments.

Moreover, SHRM practices help employees to have customized training modules, facilitating employee engagement. Similar findings were reported by Kambur & Yildirim [107]. Moreover, Newman et al. [109] analyzed similar findings and investigated the positive association between the perception of corporate social responsibility and employee performance. Furthermore, digital HR strategies must be formulated as per upcoming intelligent technologies to maximize employee engagement. Also, our results were consistent with Nankervis et al. [1].

Hypothesis H4, management support influences the relationship among DHRM, EENG and OP is supported (Table 6). Management can provide funds and necessary infrastructure and facilitate training and educational programs which help to enhance OP. The results are very much aligned with the Diamantidis & Chatzoglou [110]. Moreover, social exchange theory also discusses whether the management is concerned for the employees and supportive; this reciprocates into high EENG and OP. Furthermore, top management can contribute significantly to the psychological well-being of employees, which helps to engage employee at behavioral, cognitive and emotional level. The results of Hypothesis H5 show that there is a significant association between EENG and OP ($\beta = 0.215$, $p = 0.001$). Once DHRM practices are adopted, employee engagement and organizational performance enhance. Engaged employees performed their roles beyond expectations leading to extraordinary results and higher OP. Abdullahi et al. [111] discussed similar findings and further analyzed the impact of EENG on employee performance.

5.1. Implications

DHRM allows the business managers to draw data-driven decisions concerning policies, procedures, recruitment, training, and other crucial HR functions. The findings of our research have significant implications. Our research highlights that DHRM tools and techniques result in enhancing organizational performance. The following are the key implications:

a. Organizations must be dynamic and focus on research and development activities to ease adoption of advanced technologies and successfully adopt DHRM. Also, it helps the organization to explore more viable, effective, and efficient HRM solutions.
b. Organizations must create a positive organizational culture, develop supportive organizational policies, and ensure that employees are engaged to implement DHRM effectively. Moreover, by doing so, they are in a better capacity to align employees with organizational goals and objectives, resulting in enhanced productivity and efficiency. Therefore, results are aligned with social exchange theory.
c. Top Management plays a crucial role and significantly impacts the relationship between SHRP and EENG. The results of SHRM become substantial if DHRM is adopted. SHRP helps to make the system transparent with respect to rewards, recognition, and incentive policies, irrespective of racial discrimination, thereby resulting in enhanced employee satisfaction.
d. Managers must formulate strategic approaches for transitioning to DHRM practices as its adoption is complex and time-consuming.
e. It is highly essential for the organizations to implement cybersecurity protocols to ensure data safety and confidentiality. These initiatives help the organizations towards DHRM adoption.

Adopting digital technologies is highly emerging in human resource management; however, it is subjected to various challenges. Strategic initiatives must be taken to overcome the challenges and ensure its successful adoption. HR professionals must imbibe the required values and supportive culture. Moreover, HR managers should focus on securing a positive work environment and ensuring work engagement and adoption of sustainable practices.

6. Conclusion and scope for future work

The proposed study is carried out in India, an emerging economy. Since India, the most densely populated country, has a diverse workforce, adopting DHRM practices is essential. Handling such a vast workforce may become tedious for organizations, particularly for HR professionals. Also, the workforce comprises different ethnicities, cultural values, and religions, so DHRM helps provide relevant support so that employees feel valued while working in organizations. Besides this, adopting DHRM practices helps streamline and automate the HR processes. Moreover, since the population in rural areas is quite large, DHRM can facilitate better connections between citizens and multinational corporations by designing localized job portals. Furthermore, the presented research aids literature by developing a framework for analyzing DHRM aspects. Across the globe, leading domestic and global organizations, including electronics, automobiles, healthcare, and tourism, are curious to adopt DHRM. In the coming times, almost every HRM function is forecasted as digital, including recruitment, onboarding, conducting interviews, performance assessment, and compensation management. The adoption of DHRM substantially reduces time and enhances the productivity and performance of the industry. Also, the research results are consistent with social exchange and dynamic capability theory. DHRM facilitates sustainable HR practices, which in turn helps improve employee engagement, making the system more flexible, agile, and responsive. Furthermore, the organization must be dynamic and keep updating to survive in the competitive marketplace.

Moreover, AI and ML tools can help HR professionals determine employee turnover probability. Therefore, analyzing real-time data using advanced analytics allows managers to take quick and effective action regarding various aspects of HRM. Proactive decisions help the HR managers to deal with anomalies and overcome the challenges encountered well on time. Also, DHRM practices save time, significantly reducing wastage and paper usage and therefore facilitate eco-friendly workspaces. All these initiatives contribute momentously towards achieving SHRP. Since DHRM is highly emerging, there are distinct aspects that need investigation. Therefore, future research can more deeply assess digital transformation applications in various HR areas, such as recruitment, performance management, and employee engagement. DHRM can substantially affect employee experience and satisfaction, especially in the context of technology's increased use in the workplace. The HR professionals must motivate the employees to be more engaged in organizational activities. Training and development programs, rewards, and recognition can be provided to boost employee morale and participation. Moreover, organizations must develop dynamic capabilities to enhance work performance and compete globally.

Future research can examine how DHRM practices impact triple bottom line (TBL) practices. Also, digitalizing HR processes raises concerns about cyber security and privacy. Future research studies can explore robust measures organizations can take to secure sensitive HR data and protect employees' privacy in a digital environment. Moreover, given the globalization of work, it is essential to understand how DHRM practices vary across cultures. Since the presented study collected cross-sectional data, longitudinal studies can be conducted for more detailed analysis. Moreover, DHRM critical success factors can be explored and analyzed using advanced multi-criteria decision-making (MCDM) techniques.

Disclosure statement

No potential conflict of interest was reported by the author (s).

Data availability statement

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

CRediT authorship contribution statement

Naveen Virmani: Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Shikha Sharma:** Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation. **Pranav Kumar:** Writing – original draft, Visualization, Investigation, Formal analysis, Data curation. **Sunil Luthra:** Writing – original draft, Visualization, Validation, Methodology, Formal analysis, Data curation. **Vranda Jain:** Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation. **Sandeep Jagtap:** Writing – review & editing, Validation, Supervision, Project administration, Funding acquisition, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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