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Sustainable Human Resources Management, a Strategy Toward Sustainable Organizational Development; Emphasizing Social Sustainability with a Fuzzy Dematel Approach

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ABSTRACT

Human assets have become the foremost source of competitive advantage in today's world trade environment. The rise and improvement of the unused concept of maintainable human asset administration is one of the concepts that puts the organization in line with maintainable advancement. For this reason, analysts, senior directors, and administration specialists, by emphasizing and tending to the issue of human resource administration, look to attain the sustainable development of organizations. This research advances the field of Sustainable Human Resource Management (SHRM) by addressing a notable theoretical gap: the integration of social sustainability factors using the Fuzzy DEMATEL approach. Despite the extensive literature on SHRM, there is a scarcity of frameworks that systematically incorporate social sustainability. Our study employs a Systematic Literature Review (SLR) methodology, meticulously outlining inclusion and exclusion criteria for article selection, spanning from 1984 to 2020. We adopted a mixed-method approach combining qualitative assessments with quantitative Fuzzy DEMATEL analysis. Data were gathered through a survey distributed among 17 experts in both corporate and academic settings, ensuring a robust evaluation of social sustainability factors within HRM practices. The research identified critical social sustainability indicators and examined their interrelationships, providing a nuanced understanding of their dynamics within organizations. The findings not only bridge the existing theoretical void but also offer practical frameworks for organizations aiming to enhance their sustainability through HRM. Recommendations for both practice and future research are discussed, emphasizing the need for more empirical studies to validate the proposed framework.

Keywords

Sustainable human resources management, Sustainable organizational development, Social sustainability of human resources, Fuzzy dematel approach.

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1. Introduction

In recent years, the discourse on Sustainable Human Resource Management (SHRM) has expanded, yet the integration of social sustainability remains underexplored (Garza-Reyes et al., 2019; Nadeem et al., 2019). Current literature focuses predominantly on environmental and economic sustainability, with less attention given to the social dimensions that are equally crucial for comprehensive sustainability practices within organizations Ehnert et al. (2013). This study seeks to fill this void by integrating contemporary insights from the latest studies, particularly those published in the last five years, ensuring that the framework developed is reflective of current challenges and practices.

Whereas supportability is frequently related to fabric and generation procedures administration, Human Asset Administration (HRM) plays a pivotal part in its common integration. Supportability diverts consideration to HRM's capacity to maintain the human asset base inside, contributing to organizational practicality. Later, it is considered to demonstrate a developing interest within the crossing point of supportability and HRM. Maintainable Human Asset Administration (SHRM) is conceptualized as a system for the working relationship and a donor to maintainable improvement (Ehnert, 2009a; Gollan, 2000; Zaugg et al., 2001). Ehnert (2009b) emphasized the need for more SHRM practices, considering sustainability as strategically important for HRM.. SHRM is characterized by Ehnert (2009b) as "the design of arranged or rising human asset arrangements and exercises planning to empower a adjust of organizational objective accomplishment and generation of the human asset base over a long-lasting calendar time and to control for negative affect on the human asset base."

It considers upgrading the existing SHRM writing by conducting a precise audit and proposing a conceptual system for the selection of supportability through SHRM. This paper methodically surveys the concept of SHRM and distinguishes markers of SHRM appropriation, giving important bits of knowledge to specialists, scholastics, and analysts. The consequent areas of the paper are organized as follows:

Segment 2 presents the efficient writing survey; Area 3 dives into the concept, models, and Markers of SHRM, incorporating Natural, social, and financial, whereas Segment 4 examines approximately fluffy Dematel Strategy at that point clarifies In connection to the effect and adequacy of social components of maintainable human asset administration on each other through the conveyance of surveys among 17 human asset administration pros. Finally, Segment 5 presents the created conceptual system and offers proposals with respect to the realization of feasible human asset administration through the investigation of inquiries about

discoveries. At that point, it bargains with the restrictions of the inquiry and makes recommendations for future investigations.

2. Systematic literature review approach

This review critically examines recent contributions to SHRM, particularly those that have emerged in the last five years. These contemporary studies show SHRM's evolving nature and its increasing emphasis on social sustainability factors, which previous studies have not thoroughly addressed. By integrating these up-to-date insights, this research not only aligns with the latest academic discourse but also enhances the theoretical framework by highlighting the importance of social factors in SHRM.

2.1. Statement of the problem

While SHRM is well-documented in terms of environmental and economic aspects, there is a distinct lack of comprehensive models that incorporate social sustainability. This research addresses this gap by proposing a model that integrates social sustainability into SHRM, focusing on factors such as social justice, workforce diversity, and employee well-being. The added value of this study lies in its systematic approach to embedding these social factors into the operational strategies of HRM, thereby providing a balanced perspective on sustainability that supports organizational goals while promoting social equity and employee satisfaction. Table 1 traces the five stages that the SLR experienced.

Table 1. Systematic literature review phases

No	SLR Phase	Objective and methods used
1.	Scope formulation	Defining the scope of research to be in the bounds of Sustainable human resource management
2.	Locating studies	To locate studies, the following criteria were defined: □ Duration: 1984-2020 □ Electronic databases such as Elsevier, Science Direct, Sage, JSTOR, Emerald, Taylor and Francis, Inderscience, IGI, EBSCO, John Willey, and Springer were explored □ Keywords: sustainable human resource management, Human Resources and Sustainability, Green Human resource management, and environmental Human resource management
3.	Study selection	Published research papers with sustainability aspect (environmental, social and economic) and its implementation in HRM, were selected
4.	Analysis & synthesis	Identifying the indicators, drivers, barriers, and benefits of SHRM adoption to benefit practitioners, academics, and researchers
5.	Drawing the conceptual framework	Developing a conceptual framework for sustainability adoption through SHRM.

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The SLR enveloped peer-reviewed diary papers traversing the period from 1984 to 2020. 1984 was set up as the base year due to the nonappearance of noteworthy considerations on SHRM sometime recently. The audit considered nearly all inquiries about papers relating to SHRM, green HRM, triple-bottom-line, Vital HRM, and HR and supportability. Different databases, including Elsevier, Science Coordinate, Sage, JSTOR, Emerald, Taylor and Francis, Inderscience, IGI, EBSCO, John Wiley, and Springer, were utilized for writing the investigation. The papers chosen centered particularly on the supportability perspectives (natural, social, and financial) and their integration into HRM.

The introductory look utilized watchwords such as maintainable human asset administration, Human Assets and Maintainability, Green Human asset administration, and natural Human asset administration, utilizing distinctive combinations related to maintainability and HRM. This introductory look yielded 1,105 papers, which were at that point refined by expelling duplications, coming about in 586 papers. A cautious survey of abstracts advance diminished the number by 320 papers. In this way, 266 papers experienced exhaustive evaluation to guarantee arrangement with the inquiry center, and eventually, 163 papers were chosen for consideration within the precise writing audit.

3. Sustainable human resource management

Feasible Human Asset Administration (SHRM) could be a burgeoning field; however, restricted inquiry has been conducted on this subject, fundamentally due to its rising nature (Sosik et al., 2002; Wehling et al., 2009). Agreeing with the definition provided by Jarlstrom et al. (2018), the elemental concept supporting discourses on SHRM is that organizations point to different results to meet the desires of their partners. These results include financial, social, human, and environmental measurements, with organizations frequently seeking after them concurrently, indeed in spite of the fact that one or two may hold more importance for an organization than the others. Numerous organizations readily unveil their financial, social, and biological supportability execution (Schaltegger and Wagner, 2006; Sena and Shani, 2008).

3.1. Models of sustainable human resource management

Economic Human Asset Administration (SHRM) could be a powerfully advancing field, and the writing presents a few profitable models. One scholastically and experimentally approved show, proposed by Zaugg et al. (2001), relates SHRM with workers showing self-responsibility and effectively taking part in organizational decision-making. The victory of SHRM is gaged

from both organizational and representative points of view. Organizational financial value-added, adaptability, and practicality contribute to the organizational see, whereas representative employability, well-being, and self-responsibility contribute to the employee's point of view. Ehnert (2009c) emphasized a maintainable asset administration approach, highlighting organizations' reliance on the survival of their situations. This approach consolidates the partner hypothesis, the resource-based see, and the framework hypothesis. Zaugg's (2001) Swiss demonstration, grounded in observational investigation, gives an orderly conceptualization of SHRM through conceptual and subjective case considers.

Cohen et al. (2012) distinguish three SHRM characteristics: value, well-being, and worker advancement, with five prerequisites, compliance, administration, morals, culture, and administration. De Prins et al. (2014) propose the "Regard, Openness, and Coherence" (ROC) show, centering on regard for inside partners, openness towards natural mindfulness in HR, and coherence in long-term financial and societal maintainability.

Gollan and Xu (2014) pinpoint outside and inner drivers for SHRM, counting advertising, innovation, administrative changes, culture, clients, administration, and administration fashion. Additionally, Kramar (2014) centers on the supportability of human assets, recognizing outside drivers such as advertising elements, innovation, and administrative changes, as well as inside drivers like culture, clients, authority, and administration fashion. Gollan and Xu (2014) unequivocally diagram SHRM results in terms of efficiency, benefit, worker fulfillment, commitment, advancement, value, and well-being. Kramar (2014) classifies results into organizational, social, personal, and environmental measurements, displaying SHRM as an arranged or rising design of HR strategies/practices that accomplish budgetary, social, and biological objectives while supporting the HR base long-term.

In the midst of expanding partner weight, natural concerns are complemented, inciting companies to create arrangements and programs for naturally maintainable trade hones and compliance with natural controls (Yadav et al., 2016). Table 2 outlines the measurements of different SHRM models.

Table 2. Models of sustainable HRM

Author	Model	Dimensions
(Tabatabaei et al., 2017)	Sustainable HRM Model based on BSC	Sustainable HRM within strategic management, Sustainable HRM strategies
(Kramar, 2014)	Sustainable HRM	Sustainable work systems negative externalities
(De Prins et al., 2014)	Respect,openness, and continuity (ROC) model	Respect for the employees, Environmental awareness in perspective on HRM, Long-term approach (economic and societal sustainability and Individual employability
(Mariappanadar and Kramar, 2014)	Sustainable HRM	"Harm" of efficiency-oriented on stakeholders and externalities
(Ehnert et al., 2013)	Practice-Based Model For the Sustainability-HRM Link	Internal and external drivers, Sustainability objectives at the corporate level, HR-related sustainability objectives and HR-related activities
(Ehnert, 2009)	Paradox framework for SHRM	Human capital, Normative interpretations of sustainability, Efficiency interpretations of sustainability
(Martín-Alcazar et al., 2005)	Integrative model	Social responsibility, Efficiency, And substance-oriented understanding of sustainability. Relationship between HRM strategy and corporate strategy
(Zaugg et al., 2001)	The Three Pillars of SHRM	Work-life balance, Personal autonomy in professional development, Employability of the workers

3.2. Indicators of sustainable human resource management

SHRM, a concept characterized as a long-term approach to socially responsible and economically viable recruitment, selection, development, deployment, and release of employees (Thom and Zaugg, 2004), aligns with the Brundtland Commission's sustainability goals. The Commission declares that sustainability can be achieved at three points, with SHRM playing a significant role in this process:Financial, natural, and social, without gambling common life conditions (Ehnert, 2009b). Various ponders have highlighted that Natural, Social, and Financial Maintainability serve as key pointers and variables impacting human asset supportability. Companies are progressively recognizing the interconnecting between maintainability and its effect on their organizations. Thus, organizations are increasingly looking for ways to move into economic substances by emphatically affecting financial, natural, and social perspectives. These changes are moreover impacting HR maintainability.

3.2.1. Environmental sustainability

Natural supportability points to forming a secure environment and endeavors to play down negative impacts while effectively tending to natural issues. Organizations are progressively embracing green administration hones to upgrade their natural execution (Jabbour et al., 2016;

Udokporo et al., 2020). Various consider centering on green administration and green Human Asset Administration (HRM) hones (Ahmad, 2015; Masri and Jaaron, 2017; Mittal and Sangwan, 2014; Opatha and Anton Arulrajah, 2014; Prasad and Agarwal, 2013; Vij and Mumbai, 2013) have highlighted the relationship between green HR hones, such as green enlistment and choice, green preparing and advancement, green execution administration, green compensate frameworks, green worker relations, and favorable natural execution. Guerci et al. (2016) found that green preparation and association, green execution, and green stipend all contribute to environmental performance. Table 3 outlines the pointers for natural maintainability within the setting of SHRM.

Table 3. Environmental sustainability indicators of SHRM

Indicators	References
Green job design	Revill (2000), Daily and Huang (2001), Govindarajulu and Daily (2004), Jabbour and Santos (2008), Renwick et al. (2013), Opatha and Arulrajah (2014), Arulrajah et al. (2015), Tooranloo et al. (2017)
Green employment	Prasad and Agarwal (2013), Jackson et al. (2014), Ahmad (2015), Arulrajah et al. (2015), Tooranloo et al. (2017)
Green selection	Crosbie and Knight (1995), North (1997), Revill (2000), Jabbour and Santos (2008), Renwick et al. (2013), Chan et al. (2014), Opatha and Arulrajah (2014), Arulrajah et al. (2015), Bangwal and Tiwari (2015), Jepsen and Grob (2015), Tooranloo et al. (2017), Wehrmeyer (2017)
Green performance evaluation	Milliman and Clair, (1996), Prasad and Agarwal (2013), Renwick et al. (2013), Jackson et al. (2014), Opatha and Arulrajah (2014), Ahmad (2015), Arulrajah et al. (2015), Tooranloo et al. (2017), Wehrmeyer (2017)
Green training	Cook and Seith (1992), North (1997), Jabbour (2013), Prasad and Agarwal (2013), Renwick et al. (2013), Chan et al. (2014), Jackson et al. (2014), Opatha and Arulrajah (2014), Arulrajah et al. (2015), Guerci et al. (2016), Tooranloo et al. (2017)
Green reward system management	Bhushan and MacKenzie (1992), Crosbie and Knight (1995), Berry and Rondinelli (1998), Ramus (2001), Daily et al. (2003), Govindarajulu and Daily (2004), Prasad and Agarwal (2013), Renwick et al. (2013), Jackson et al. (2014), Opatha and Arulrajah (2014), Ahmad (2015), Arulrajah et al. (2015), Jabbour et al.(2016), Guerci et al. (2016), Tooranloo et al. (2017)
Green compensation system management	Ramus (2002), Fernández et al. (2003), Phillips (2007), Tooranloo et al. (2017)
Green health and employees' safety management	Ditz et al.(1995), Ahmad (2015), Arulrajah et al. (2015), Tooranloo et al. (2017)
Green management of employee discipline	Wright and McMahan (2011), Renwick et al. (2013), Jackson et al. (2014), Opatha and Arulrajah (2014), Arulrajah et al. (2015), Tooranloo et al. (2017)
Employee green relations	Renwick et al. (2013), Ahmad (2015), Arulrajah et al. (2015), Tooranloo et al. (2017)
Green recruitment	Phillips (2007), Stringer (2010), Jabbour (2013), Renwick et al. (2013), Jackson et al. (2014), Arulrajah et al. (2015), Jepsen and Grob (2015), Oates (2017), Wehrmeyer (2017)
Green induction	Crosbie and Knight (1995), North (1997), Revill (2000), Renwick et al. (2013), Opatha and Arulrajah (2014), Arulrajah et al. (2015), Wehrmeyer (2017)
Green HR planning	Arulrajah et al. (2015), Tooranloo et al. (2017)
Green policy implementation	Ahmad (2015), Arulrajah et al. (2015), Tooranloo et al. (2017)

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3.2.2. Social sustainability

Social supportability coordinates consideration towards the well-being of current and future eras, emphasizing the objective of upgrading the quality of life and diminishing social imbalance. Organizations endeavor to realize social maintainability by effectively supporting formal and casual forms, frameworks, structures, and connections that enable show and future eras to construct sound and decent communities. Socially feasible communities are characterized by value, differing qualities, networks, popular government, and a high quality of life. Table 4 diagrams the indicators for social maintainability within the setting of SHRM.

Table 4. Social sustainability indicators of SHRM

Indicators	References
Social infrastructure The availability of career opportunities	Ahmad and Schroeder (2002), Chan and Lee (2008), Tooranloo et al. (2017) Stiglitz (2008)
Accessibility	Smith (2000), Tooranloo et al. (2017), Yeh and Ng (2017)
Ability to fulfil the psychological needs	Ahmad and Schroeder (2002), Turkington and Sangster (2006), Chan and Lee (2008), Mampra (2013), Aragon-Correa et al. (2015), Tooranloo et al. (2017)
Social justice	Dempsey et al. (2011), Tooranloo et al. (2017)
Social sustainability design	Dempsey et al. (2011), Tooranloo et al. (2017)
Corporate social responsibility	Peneda Saraiva and Silva Serrasqueiro (2007), Crane et al. (2008), Teck Hui (2008), Tooranloo et al. (2017)
Social sustainability	Littig and Griessler (2005), Bramley et al. (2009), Dempsey et al. (2011), Tooranloo et al. (2017)

3.2.3. Economic sustainability

Financial maintainability is closely tied to take-toll diminishment, the conservation of profitable assets for future eras, and successful asset administration (Garza-Reyes et al., 2019; Munasinghe, 1993; Nadeem et al., 2019). Within the setting of SHRM, maintainability is seen as a common advantage for all partner bunches and a commitment to long-term financial supportability. As per Nadeem et al. (2018), supportability is the mode of improvement that permits financial and social advancement without draining natural assets while following moral, ethical, and socially and financially sound standards. Table 5 traces the indicators for financial maintainability within the domain of SHRM.

Table 5. Economic sustainability indicators of SHRM

Indicators	References
HR efficiency	Copus and Crabtree (1996), Youndt et al. (1996), Tooranloo et al. (2017)
Re-engineering/ Restructuring	Love and Gunasekaran, (1997), Tooranloo et al. (2017)
Cost reduction strategy	Hanegraaf et al. (1998), Tooranloo et al. (2017)
Senior management commitment	Tisdell (1996), Glaser and Diele (2004), Tooranloo et al. (2017)
Development of facilities	Tisdell (1996), Vincent (1997), Tooranloo et al. (2017)
Macroeconomic policies	Copus and Crabtree (1996), Vincent (1997), Hanegraaf et al. (1998), Epstein et al. (2008), Tooranloo et al. (2017)
Employment guarantee	Glaser and Diele (2004), Basu et al. (2009), Jha et al. (2013)

4. Methodology

4.1. Systematic literature review (SLR) approach

4.1.1. SLR Design and implementation

The Systematic Literature Review (SLR) conducted in this study was designed to ensure a comprehensive and unbiased review of existing literature on Sustainable Human Resource Management (SHRM), focusing specifically on the integration of social sustainability factors. The SLR followed a structured process:

1. Definition of Scope and Objectives: The scope of this SLR was to identify and analyze studies that discuss SHRM practices with an emphasis on social sustainability. The primary objective was to assess the extent of existing research and identify gaps in the literature, particularly in terms of theoretical and practical applications.
2. Database and Search Strategy: The search strategy was meticulously designed, covering a wide range of reputable databases including Elsevier, ScienceDirect, Sage, JSTOR, Emerald, Taylor and Francis, Inderscience, IGI, EBSCO, John Wiley, and Springer. The keywords used in the search were carefully selected to ensure a comprehensive retrieval of relevant literature, including combinations of "Sustainable Human Resource Management," "Social Sustainability," "Human Resources," and "Fuzzy DEMATEL."
3. Inclusion and Exclusion Criteria:
    - Inclusion Criteria: Articles were included if they were peer-reviewed journal articles published in English from 2015 onwards, focused on SHRM, and specifically addressed social sustainability within organizational settings.
    - Exclusion Criteria: Studies were excluded if they were published before 2015, focused solely on environmental or economic sustainability without incorporating social aspects, were not peer-reviewed (e.g., conference papers, book chapters, editorials), or did not

provide empirical data or theoretical frameworks relevant to SHRM and social sustainability.

4. Selection Process: The selection process was rigorous and systematic. Initially, titles and abstracts were screened based on the inclusion criteria, followed by a full-text review to ensure alignment with the research objectives. This two-step screening process was designed to ensure that only the most relevant and recent studies were included in the review, enhancing the validity of the findings.
5. Data Extraction and Synthesis: The data extraction and synthesis process was conducted with meticulous attention to detail. Key information was extracted from each selected article, including author(s), year of publication, research methods, key findings, and the focus on social sustainability within SHRM. This data was then synthesized to map out the current landscape of research and identify theoretical and empirical gaps, ensuring the accuracy of the findings.
6. Quality Assessment: The quality of each included article was assessed based on a set of criteria developed for this study, including the clarity of research objectives, the robustness of the methodology, the relevance of the findings to the field of SHRM, and the contribution to understanding social sustainability.

4.1.2. Outcome of the SLR

The SLR identified a set of articles that collectively delineate the current understanding and gaps in SHRM practices with a focus on social sustainability. The findings from the SLR informed the development of a conceptual framework for integrating social sustainability in SHRM, highlighting the need for further empirical research to validate the proposed models and practices.

"This research proposes a Fuzzy DEMATEL-based framework that not only identifies but also quantifies the influence of various social sustainability factors on SHRM. Doing so fills the theoretical void by providing empirical evidence and a robust methodological approach to integrate these factors into the core strategic operations of HRM. The framework aims to balance the three pillars of sustainability — environmental, economic, and social — within the HRM strategy, thus offering a comprehensive model that can be empirically tested and applied in diverse organizational contexts."

4.2. Dematel technique: A comprehensive approach for structural modeling

The Dematel technique is outlined as a comprehensive strategy for building and scrutinizing structural models involving intricate cause-and-effect associations among factors (Tseng, 2009). This scientific and highly effective tool visually represents complex causal connections through matrices or diagrams. These matrices and diagrams portray the internal relationships among the elements within a system, illustrating the strength of influence and permeability of each element (Patil, 2013). Consequently, the Dematel method is adept at converting the cause-and-effect relationships of criteria into a sensible structural model. Considering the frequent use of expert opinions in the Dematel method, often articulated in non-transparent linguistic descriptions, it is recommended to translate expert language into fuzzy numbers for coherence and to eliminate ambiguity (Pamucar et al., 2017) .To achieve this, a proposed model utilizes Dematel in fuzzy conditions. The Fuzzy DEMATEL (Decision Making Trial and Evaluation Laboratory) method integrates fuzzy logic with DEMATEL to analyze cause-effect relationships within a system while accommodating ambiguity in expert judgments (Nasri et al., 2022).

In the Fuzzy DEMATEL analysis, we utilized trapezoidal fuzzy numbers to represent the intensity of influence between elements in the model. This choice is due to their ability to more accurately capture the range and uncertainty of expert judgments compared to triangular fuzzy numbers. Four parameters define each fuzzy number: (l,m,n,o)(l,m,n,o), where:

• ll (lower limit) represents the minimum value that reflects the lowest possible level of influence.

• mm (lower mean) signifies a more conservative estimate of influence, still on the lower side but recognized by experts as plausible.

• nn (upper mean) captures a more commonly agreed upon estimate of influence among the experts.

• oo (upper limit) represents the maximum potential influence as perceived by any expert.

For the purpose of this study, the scale used to define these parameters was structured as follows:

0: No influence
1: Very low influence
2: Low influence
3: Moderate influence
4: High influence
5: Very high influence

Each level of influence was subsequently mapped to a trapezoidal fuzzy number constructed based on expert elicitation. For example, a 'Moderate influence' might be represented as (2,3,3,4)(2,3,3,4), indicating a consensus around moderate influence with potential deviations toward low or high based on different expert opinions.

These fuzzy numbers are essential for the Fuzzy DEMATEL calculation as they allow for a nuanced analysis of the interdependencies and influence levels among factors in sustainable human resource management, capturing the inherent uncertainties in expert assessments.

4.3. Sample community and tools

The current research is applied in terms of purpose and descriptive survey in terms of nature and method. Allan Gibb's model (2020) was used to collect the required information from library studies and to determine the indicators that were examined (Gibb, 2020). In fact, for this research, a fuzzy multi-criteria decision-making model using a fuzzy Dematel-based modeling approach, a Dematel-based weighting system in a fuzzy environment, and examining the leveling of indicators and internal connections between factors affecting the development of sustainable human resources Emphasizing social factors, it has been used to rank the importance of influence and effectiveness of each factor.

4.4. Dematel method steps

Step 1: Formation of fuzzy direct relationship matrix

To discern the pattern of relationships among criteria, an n×n matrix is first established. In this matrix, the influence of each element listed in a row on the elements listed in a column is expressed as a fuzzy number. In cases where multiple expert perspectives are considered, each expert is required to complete the matrix. Afterward, the simple average of the utilized opinions is computed, resulting in the formation of the fuzzy direct relationship matrix denoted as "z."in Equation 1.

$$Z\begin{bmatrix} 0 \dots z_{n\sim 1} \\ z_{1\sim n} \dots 0 \end{bmatrix} \quad (1)$$

Table 6 illustrates the direct relationship matrix, which essentially reflects pairwise comparisons of experts (Patil and Kant, 2014). if multiple experts are involved in the assessment, the matrix represents the arithmetic mean of all experts' contributions.

Table 6. Direct relationship matrix

Factors	Social infrastructure	The availability of career opportunities	Accessibility	Ability to fulfil the psychological needs	Social justice	Social sustainability	Corporate social responsibility	Social sustainability design
Social infrastructure	(0.000,0.000, 0.000)	(0.206,0.397, 0.618)	(0.235,0.426, 0.647)	(0.088,0.265,0.500)	(0.324,0.559,0.794)	(0.176,0.397, 0.647)	(0.015,0.147, 0.353)	(0.176,0.353, 0.588)
The availability of career opportunities	(0.059,0.118, 0.206)	(0.000,0.000, 0.000)	(0.059,0.176, 0.353)	(0.132,0.294,0.515)	(0.162,0.353,0.588)	(0.103,0.309, 0.529)	(0.088,0.176, 0.324)	(0.059,0.206, 0.397)
Accessibility	(0.088,0.176, 0.324)	(0.088,0.235, 0.397)	(0.000,0.000, 0.000)	(0.147,0.294,0.471)	(0.250,0.456,0.706)	(0.132,0.309, 0.544)	(0.118,0.250, 0.412)	(0.088,0.265, 0.500)
Ability to fulfil the psychological needs	(0.044,0.147, 0.309)	(0.147,0.265, 0.397)	(0.074,0.176, 0.309)	(0.000,0.000,0.000)	(0.088,0.206,0.412)	(0.221,0.426, 0.662)	(0.118,0.250, 0.426)	(0.147,0.294, 0.544)
Social justice	(0.353,0.559, 0.779)	(0.250,0.456, 0.676)	(0.353,0.574, 0.809)	(0.191,0.382,0.618)	(0.000,0.000,0.000)	(0.279,0.500, 0.735)	(0.235,0.426, 0.662)	(0.279,0.515, 0.765)
Social sustainability	(0.235,0.456, 0.706)	(0.147,0.324, 0.559)	(0.132,0.324, 0.559)	(0.206,0.412,0.647)	(0.279,0.500,0.735)	(0.000,0.000, 0.000)	(0.176,0.338, 0.588)	(0.338,0.574, 0.824)
Corporate social responsibility	(0.147,0.294, 0.529)	(0.103,0.221, 0.397)	(0.309,0.485, 0.721)	(0.088,0.250,0.456)	(0.206,0.397,0.647)	(0.191,0.426, 0.676)	(0.000,0.000, 0.000)	(0.191,0.426, 0.676)
Social sustainability design	(0.250,0.471, 0.721)	(0.162,0.368, 0.574)	(0.176,0.397, 0.647)	(0.118,0.294,0.529)	(0.309,0.529,0.765)	(0.338,0.588, 0.824)	(0.103,0.309, 0.559)	(0.000,0.000, 0.000)

The following table shows the fuzzy range used in the model:

Table 7. fuzzy range used in the model

Code	Linguistic term	L	M	U
0	No influence	0	0	0/25
1	Very low influence	0	0/25	0/5
2	Low influence	0/25	0/5	0/75
3	High influence	0/5	0/75	1
4	Very high influence	0/75	1	1

Step 2: Normalizing the fuzzy direct relation matrix

The following equation is used to normalize the fuzzy direct relation matrix (Table 8):

Table 8. Fuzzy direct relation matrix

Factors	Social infrastructure	The availability of career opportunities	Accessibility	Ability to fulfil the psychological needs	Social justice	Social sustainability	Corporate social responsibility	Social sustainability design
Social infrastructure	(0.000,0.000,0.000)	(0.041,0.079,0.123)	(0.047,0.084,0.128)	(0.017,0.053,0.099)	(0.064,0.111,0.157)	(0.035,0.079,0.128)	(0.003,0.029,0.070)	(0.035,0.070,0.117)
The availability of career opportunities	(0.012,0.023,0.041)	(0.000,0.000,0.000)	(0.012,0.035,0.070)	(0.026,0.058,0.102)	(0.032,0.070,0.117)	(0.020,0.061,0.105)	(0.017,0.035,0.064)	(0.012,0.041,0.079)
Accessibility	(0.017,0.035,0.064)	(0.017,0.047,0.079)	(0.000,0.000,0.000)	(0.029,0.058,0.093)	(0.050,0.090,0.140)	(0.026,0.061,0.108)	(0.023,0.050,0.082)	(0.017,0.053,0.099)
Ability to fulfil the psychological needs	(0.009,0.029,0.061)	(0.029,0.053,0.079)	(0.015,0.035,0.061)	(0.000,0.000,0.000)	(0.017,0.041,0.082)	(0.044,0.084,0.131)	(0.023,0.050,0.084)	(0.029,0.058,0.108)
Social justice	(0.070,0.111,0.154)	(0.050,0.090,0.134)	(0.070,0.114,0.160)	(0.038,0.076,0.123)	(0.000,0.000,0.000)	(0.055,0.099,0.146)	(0.047,0.084,0.131)	(0.055,0.102,0.152)
Social sustainability	(0.047,0.090,0.140)	(0.029,0.064,0.111)	(0.026,0.064,0.111)	(0.041,0.082,0.128)	(0.055,0.099,0.146)	(0.000,0.000,0.000)	(0.035,0.067,0.117)	(0.067,0.114,0.163)
Corporate social responsibility	(0.029,0.058,0.105)	(0.020,0.044,0.079)	(0.061,0.096,0.143)	(0.017,0.050,0.090)	(0.041,0.079,0.128)	(0.038,0.084,0.134)	(0.000,0.000,0.000)	(0.038,0.084,0.134)
Social sustainability design	(0.050,0.093,0.143)	(0.032,0.073,0.114)	(0.035,0.079,0.128)	(0.023,0.058,0.105)	(0.061,0.105,0.152)	(0.067,0.117,0.163)	(0.020,0.061,0.111)	(0.000,0.000,0.000)

Step 3: Calculating the fuzzy total relation matrix

Step 3 of the Fuzzy DEMATEL method involves calculating the Fuzzy Total Relation Matrix (T) in Equation 2. This matrix represents the direct and indirect effects of the criteria (indicators) on each other.

$$\tilde{T} = \lim_{k \to +\infty} (\tilde{x}^1 \oplus \tilde{x}^2 \oplus \ldots \oplus \tilde{x}^k) \quad (2)$$

If each row of the fuzzy number of the total relations matrix is calculated in Equation 3:

$$\begin{aligned} [l''_{ij}] &= x_l \times (I - x_l)^{-1} \\ [m''_{ij}] &= x_m \times (I - x_m)^{-1} \\ [u''_{ij}] &= x_u \times (I - x_u)^{-1} \end{aligned} \quad (3)$$

In other words, first, the inverse of the normal matrix is calculated. It is subtracted from the I matrix, and finally, the normal matrix is multiplied by the resulting matrix. Table 9 shows the complete fuzzy relation matrix.

Table 9. . Full fuzzy correlation matrix

Factors	Social infrastructure	The availability of career opportunities	Accessibility	Ability to fulfil the psychological needs	Social justice	Social sustainability	Corporate social responsibility	Social sustainability design
Social infrastructure	(0.012,0.063, 0.384)	(0.050,0.136, 0.493)	(0.057,0.147, 0.536)	(0.027,0.110,0.484)	(0.076,0.181,0.613)	(0.047,0.151, 0.587)	(0.012,0.082, 0.423)	(0.045,0.137, 0.551)
The availability of career opportunities	(0.018,0.065, 0.320)	(0.006,0.041, 0.277)	(0.018,0.079, 0.371)	(0.031,0.095,0.378)	(0.038,0.116,0.447)	(0.027,0.109, 0.438)	(0.022,0.069, 0.320)	(0.018,0.087, 0.398)
Accessibility	(0.026,0.084, 0.383)	(0.025,0.094, 0.392)	(0.010,0.055, 0.352)	(0.035,0.103,0.413)	(0.058,0.146,0.519)	(0.035,0.120, 0.492)	(0.029,0.090, 0.374)	(0.027,0.107, 0.463)
Ability to fulfil the psychological needs	(0.016,0.073, 0.354)	(0.035,0.093, 0.365)	(0.022,0.082, 0.381)	(0.006,0.043,0.301)	(0.027,0.096,0.439)	(0.051,0.133, 0.478)	(0.029,0.085, 0.351)	(0.037,0.106, 0.440)
Social justice	(0.083,0.180, 0.588)	(0.063,0.163, 0.571)	(0.085,0.193, 0.639)	(0.050,0.147,0.574)	(0.023,0.105,0.565)	(0.072,0.192, 0.687)	(0.056,0.145, 0.537)	(0.070,0.185, 0.660)
Social sustainability	(0.059,0.155, 0.549)	(0.041,0.132, 0.523)	(0.041,0.140, 0.567)	(0.050,0.144,0.548)	(0.071,0.182,0.654)	(0.017,0.091, 0.524)	(0.043,0.123, 0.499)	(0.078,0.185, 0.636)
Corporate social responsibility	(0.040,0.117, 0.480)	(0.030,0.103, 0.455)	(0.071,0.158, 0.549)	(0.026,0.106,0.476)	(0.054,0.153,0.590)	(0.049,0.156, 0.591)	(0.008,0.053, 0.357)	(0.048,0.149, 0.566)
Social sustainability design	(0.062,0.159, 0.553)	(0.044,0.140, 0.527)	(0.049,0.154, 0.583)	(0.034,0.125,0.531)	(0.076,0.189,0.661)	(0.079,0.196, 0.666)	(0.030,0.119, 0.495)	(0.015,0.084, 0.496)

Step 4: De-fuzzifying the values of the complete correlation matrix

For de-fuzzification, the CFCS epiechoic and bell method has been used. The steps of the de-fuzzification method are in Equation 4:

$$l_{ij}^{n} = \frac{\left(l_{ij}^{t} - \min l_{ij}^{t}\right)}{\Delta_{min}^{max}}$$
$$m_{ij}^{n} = \frac{(m_{ij}^{t} - min\ l_{ij}^{t})}{\Delta_{min}^{max}} \quad (4)$$
$$u_{ij}^{n} = \frac{(u_{ij}^{t} - min\ l_{ij}^{t})}{\Delta_{min}^{max}}$$

So that:

$$\Delta_{min}^{max} = \max u_{ij}^{t} - \min l_{ij}^{t}$$

Calculation of upper and lower limits of normal values witn Equation 5:

$$l_{ij}^{s} = {m_{ij}^{n}}/{(1 + m_{ij}^{n} - l_{ij}^{n})}$$
$$u_{ij}^{s} = {u_{ij}^{n}}/{(1 + u_{ij}^{n} - l_{ij}^{n})} \quad (5)$$

The output of the cfcs algorithm is a matrix with definite values.

Calculation of total normalized definitive values witn Equation 5:

$$x_{ij} = \frac{[l_{ij}^{s}(1 - l_{ij}^{s}) + u_{ij}^{s} \times u_{ij}^{s}]}{[1 - l_{ij}^{s} + u_{ij}^{s}]} \quad (6)$$

Table 10 shows the dephased values of the complete correlation matrix.

Table 10. Complete deterministic correlation matrix

Factors	Social infrastructure	The availability of career opportunities	Accessibility	Ability to fulfil the psychological needs	Social justice	Social sustainability	Corporate social responsibility	Social sustainability design
Social infrastructure	0.118	0.193	0.21	0.171	0.248	0.221	0.14	0.205
The availability of career opportunities	0.108	0.081	0.128	0.143	0.172	0.164	0.112	0.139
Accessibility	0.135	0.144	0.106	0.155	0.207	0.183	0.138	0.167
Ability to fulfil the psychological needs	0.121	0.139	0.133	0.087	0.154	0.191	0.13	0.163
Social justice	0.241	0.223	0.259	0.212	0.182	0.266	0.205	0.256
Social sustainability	0.216	0.193	0.208	0.206	0.254	0.165	0.183	0.254
Corporate social responsibility	0.177	0.162	0.221	0.167	0.223	0.225	0.105	0.216
Social sustainability design	0.219	0.2	0.22	0.189	0.26	0.267	0.178	0.155

Step 5: Threshold calculation

All the determined complete correlation matrix values that are less than the mean of the complete correlation matrix are identified and set to zero using Equation 7; in other words, the causal relationship is not considered.

$$S = \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} V_{ij}}{m \times n}$$
$$U_{ij} = \begin{cases} V_{ij} & V_{ij} \geq TS \\ 0 & Others \end{cases} \quad (7)$$

Table 10 shows the full correlation matrix with values below the threshold removed. Based on the table, causal relationships between elements are drawn. The threshold value (TS) in this research is equal to 0.1810.181.

Table 11. Complete deterministic correlation matrix with the removal of lower threshold values

Factors	Social infrastructure	The availability of career opportunities	Accessibility	Ability to fulfil the psychological needs	Social justice	Social sustainability	Corporate social responsibility	Social sustainability design
Social infrastructure	0	0/193	0/21	0	0/248	0/221	0	0/205
The availability of career opportunities	0	0	0	0	0	0	0	0
Accessibility	0	0	0	0	0/207	0/183	0	0
Ability to fulfil the psychological needs	0	0	0	0	0	0/191	0	0
Social justice	0/241	0/223	0/259	0/212	0/182	0/266	0/205	0/256
Social sustainability	0/216	0/193	0/208	0/206	0/254	0	0/183	0/254
Corporate social responsibility	0	0	0/221	0	0/223	0/225	0	0/216
Social sustainability design	0/219	0/2	0/22	0/189	0/26	0/267	0	0

Step 6: Final output and create a causal diagram

The next step is to obtain the sum of the rows and columns of the matrix T. We obtain the sum of rows (D) and columns (R) according to the Equation 8.

$$D = \sum_{j=1}^{n} T_{ij}$$
$$R = \sum_{i=1}^{n} \tilde{T}_{ij} \quad (8)$$

Then, according to D and R, we obtain the values of D+R and D-R, which indicate the degree of interaction and the influence of the factors, respectively.

The final output is shown in Table 12.

Table 12. final output

	R	D	D+R	D-R
Social infrastructure	1/336	1/505	2/842	0/169
The availability of career opportunities	1/335	1/048	2/382	-0/287
Accessibility	1/486	1/236	2/722	-0/25
Ability to fulfil the psychological needs	1/331	1/118	2/449	-0/213
Social justice	1/699	1/844	3/543	0/144
Social sustainability	1/682	1/68	3/361	-0/002
Corporate social responsibility	1/191	1/496	2/687	0/305
Social sustainability design	1/554	1/688	3/242	0/133

Figure 1 also shows the pattern of significant relationships. This pattern is in the form of a chart in which the longitudinal axis is based on D + R values, and the transverse axis is based

on D - R. The position and relationships of each factor are determined by a point with coordinates (D + R, D - R) in the device.

Step 7: Interpret the results

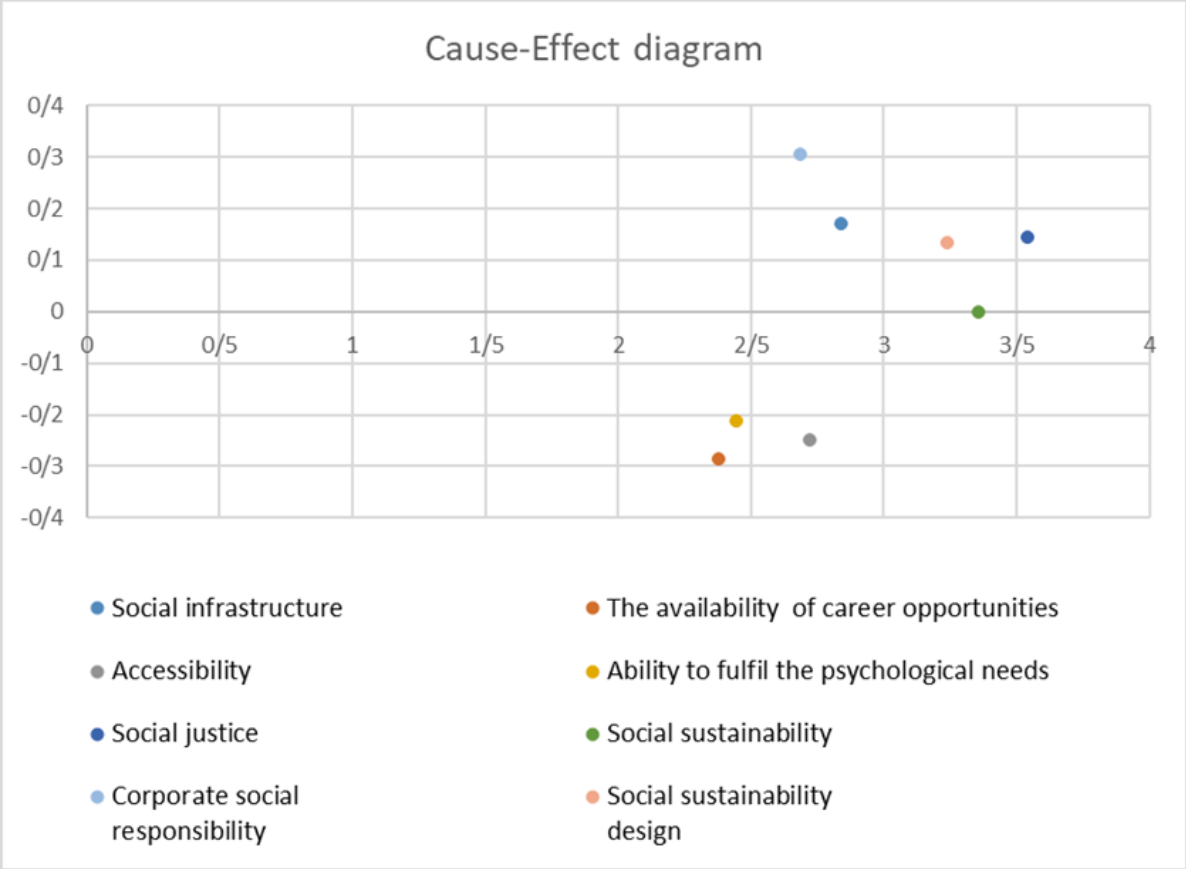

Figure 1. Cause-Effect diagram

According to the above chart and table, each factor is examined from four aspects:

- The degree of influence of variables: the sum of the elements of each row (D) for each factor indicates the degree of influence of that factor on other factors of the system. In this research, social infrastructure has the most influence, and alternative job opportunities, accessibility of disabled employees, ability to satisfy psychological needs, social justice, social sustainability, social responsibility, and social sustainability design are in the following degrees of influence.

- The degree of influence of variables: the sum of the elements of the column (R) for each factor indicates the degree of influence of that factor on other factors of the system. In this research, social justice has the highest effectiveness, and social sustainability, social sustainability design, accessibility of disabled employees, social infrastructure, alternative job opportunities, the ability to satisfy psychological needs, and social responsibility are in the following degrees of effectiveness.

- The horizontal vector (D + R) shows the influence of the desired factor in the system. In other words, the higher the D + R value of an agent, the more interaction that agent has with other system agents. In this research, social justice has the most influence. Social sustainability, social sustainability design, social infrastructure, accessibility of disabled employees, social responsibility, ability to satisfy psychological needs, and alternative job opportunities are in the following degrees of influence.

- The vertical vector (D - R) shows the influence of each factor. To clarify, if D - R is positive, the variable is considered a causal variable, meaning it has a direct impact on other factors. Conversely, if it is negative, it is considered an effect, indicating that other factors influence it.

5. Conclusion

This study investigated the concept of SHRM and its importance in promoting sustainability in an organization. Adopting a systematic literature review approach, it identified indicators, models, and influential factors of SHRM adoption. This research also provides an integrated conceptual framework that can be used to develop a sustainable business adoption through sustainable human resource management (SHRM). The results of the questionnaire distribution among the experts are as follows.

5.1. Key findings

The application of the fuzzy mathematical method revealed significant insights into the interdependencies and influences of social sustainability factors within sustainable human resource management (SHRM). Key findings include:

- Social Justice and Equity: These emerged as the most influential factors, suggesting that fairness in HR practices critically impacts other elements of social sustainability in organizations.
- Employee Well-being and Engagement: These factors are significantly influenced by organizational practices related to social justice, establishing a clear and actionable link between equitable treatment and employee satisfaction and productivity.
- Corporate Social Responsibility (CSR): While CSR was seen as influential, its impact on immediate HR practices was less than that of internal social sustainability factors, suggesting that internal practices may be more critical to sustainable HR outcomes than external CSR activities.

5.2. Analysis of findings

In this research, social infrastructure, social justice, social responsibility, and design of social sustainability are causal and alternative job opportunities, accessibility of disabled employees, ability to satisfy psychological needs, and social sustainability of the disabled are considered.

In this research, social infrastructure has the most influence, and alternative job opportunities, accessibility of disabled employees, ability to satisfy psychological needs, social justice, social sustainability, social responsibility, and social sustainability design are in the following degrees of influence. On the other hand, social justice has the highest effectiveness, and social sustainability, social sustainability design, accessibility of disabled employees, social infrastructure, alternative job opportunities, the ability to satisfy psychological needs, and social responsibility are in the following degrees of effectiveness.

1. Social Infrastructure: Social infrastructure, the backbone of a community's quality of life, including healthcare, education, and housing, is a beacon of hope for employee well-being and enhancing productivity (Shen et al., 2014).

2. The Availability of Career Opportunities: The availability of career opportunities within an organization is a key determinant of employee satisfaction and retention. Providing clear career paths and growth opportunities reassure employees and fosters organizational loyalty (Kong et al., 2012).

3. Accessibility: It's not just a buzzword; it's a commitment. A commitment to ensuring that all our employees, regardless of their abilities, feel valued and included. It's a cornerstone of our inclusive work culture (Hersh, 2015).

4. Ability to Fulfil the Psychological Needs: Fulfilling the psychological needs of employees involves creating a work environment that supports mental health, work-life balance, and a sense of belonging. It is essential for maintaining high levels of employee engagement and productivity (Ryan and Deci, 2000).

5. Social Justice: Social justice in the workplace ensures fair treatment, equality, and respect for all employees, regardless of their background. It encompasses diversity, equity, and inclusion (DEI) practices (George and Jones, 1997).

6. Social Sustainability: Social sustainability involves creating systems and processes that support the long-term well-being of employees and the communities in which organizations operate. It focuses on enhancing quality of life and fostering strong social connections (Colantonio, 2009).

7. Corporate Social Responsibility (CSR): Corporate Social Responsibility (CSR) refers to the ethical responsibility of organizations to contribute positively to society and the environment. It includes philanthropic efforts, ethical business practices, and community involvement (Carroll, 1999).

8. Social Sustainability Design: Social sustainability design focuses on creating work environments and practices that support the long-term social well-being of employees. It involves designing policies and workplaces that promote health, equity, and inclusivity (Dempsey et al., 2011).

9. Implications for Practice: The findings suggest several actionable strategies for HR professionals:

- Integrative HR Policies: Organizations should develop HR policies that integrate social justice and employee well-being into their core operations rather than treating them as separate or secondary concerns.
- Training and Development: Enhance training programs to include modules on equity, inclusion, and diversity to ensure that these values are embedded in all aspects of organizational culture.
- Performance Measurement: Adapt performance measurement systems to include criteria related to social sustainability, such as employee satisfaction and equity, to reinforce these aspects in organizational practices.

5.3. Limitations and suggestions

Like any other research, this has certain limitations. First, it relies entirely on secondary data. Further research can collect preliminary data to simultaneously exploit the concept's value. Second, it provides a conceptual framework that should be examined and validated in survey research.

5.4. Implications for research

These results open several avenues for further research:

- Longitudinal Studies: Future research could undertake longitudinal studies to examine the long-term effects of integrated social sustainability practices on organizational performance.
- Comparative Studies: Studies comparing the impacts of social sustainability in different cultural or industry contexts could provide deeper insights into the adaptability and effectiveness of SHRM practices globally.
- Quantitative Modelling: Further quantitative modeling could refine the understanding of the weight and interaction between different sustainability factors, enhancing the predictive power of SHRM models.
- Research Suggestions
- Empirical Testing: The conceptual framework developed in this study should be empirically tested across various organizational settings to validate its applicability and effectiveness.
- Integration with Other Sustainability Dimensions: Research could explore models that integrate social, environmental, and economic dimensions of sustainability in a unified HR framework.
- Practical Suggestions

- HR Training Programs: Develop and implement training programs focused on social sustainability to enhance awareness and skills among HR professionals.
- Policy Development: Encourage the formulation of policies that explicitly include social sustainability as a core component of corporate strategy.

Research findings highlight several key areas essential for achieving sustainable organizational development:

1. Social Infrastructure: Investing in healthcare, education, and housing enhances employee well-being and productivity. Organizations should invest in social infrastructure by providing employees with access to healthcare services, educational programs, and affordable housing options. Partnerships with local communities and governments can enhance these efforts, ensuring that employees have a stable and supportive environment.
2. The Availability of Career Opportunities: Clear career paths and growth opportunities motivate employees and foster loyalty. Implement a robust career development program that includes regular training, mentorship opportunities, and clear pathways for advancement. Regularly review and update job descriptions and roles to reflect changing market demands and employee aspirations.
3. Accessibility: Ensuring that all employees can access necessary resources and accommodations promotes effectiveness and inclusivity. Ensure workplace accessibility by adhering to universal design principles, providing necessary accommodations, and utilizing technology to facilitate remote work options. Regular audits and feedback mechanisms can help identify and address accessibility issues promptly.
4. Ability to Fulfil the Psychological Needs: Creating a supportive work environment that addresses mental health and work-life balance increases employee engagement. Develop and implement wellness programs that include mental health resources, flexible working hours, and opportunities for social interaction. Encourage a culture of openness where employees feel comfortable discussing their mental health needs.
5. Social Justice: Fair treatment and respect for all employees through comprehensive DEI practices are critical for a harmonious workplace. Adopt comprehensive DEI policies, conduct regular bias training, and ensure equitable hiring, promotion, and pay practices. Establishing a diversity committee can help oversee and promote these initiatives within the organization.
6. Social Sustainability: Integrating long-term well-being goals into corporate strategies supports both employees and communities. Integrate social sustainability goals into the corporate strategy by setting measurable targets related to employee welfare, community engagement, and social impact initiatives. Regularly report on progress and adjust strategies based on feedback.
7. Corporate Social Responsibility (CSR): Ethical business practices and community involvement enhance the organization’s positive social impact. Develop a comprehensive CSR strategy that aligns with the company's values and mission. Engage employees in CSR activities, such as volunteer programs and charitable giving, and ensure transparent reporting of CSR efforts and their impacts.
8. Social Sustainability Design: Designing inclusive, healthy, and flexible workspaces fosters a supportive and collaborative environment. Incorporate social sustainability principles into workplace design by creating inclusive, healthy, and flexible workspaces. Use ergonomic furniture, provide access to natural light, and create communal areas that encourage social interaction and collaboration.

These indicators underscore the necessity for organizations to adopt a holistic approach towards SHRM. By integrating social sustainability factors, organizations can not only achieve a competitive advantage but also contribute to the broader goal of sustainable development. The Fuzzy DEMATEL approach proved effective in identifying and analyzing the complex relationships among social sustainability indicators, providing a nuanced understanding of their dynamics.

Practitioners, as the key implementers, should leverage these insights to implement HRM practices that prioritize social sustainability, thereby fostering a positive organizational culture and long-term sustainability. Future research should focus on empirical validation of the proposed framework and explore additional social sustainability factors that may impact SHRM, empowering the audience with a sense of responsibility.

In conclusion, this study bridges a significant theoretical gap in SHRM literature and offers practical frameworks for organizations. By emphasizing the integration of social sustainability, we pave the way for more comprehensive and sustainable HRM practices.

Disclosure statement

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

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