DEVELOPING A MODEL FOR ASSESSING THE EFFICIENCY OF SUSTAINABLE HUMAN RESOURCE MANAGEMENT IN CONSTRUCTION PROJECTS

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ARTICLE INFO

***Article history*:**
Received: 09.08.2024.
Received in revised form: 11.03.2025.
Accepted: 11.03.2025.

Keywords:
Human resources management
Sustainable development
Content analysis
Construction industry
Analytic hierarchy process
Efficiency evaluation

DOI: https://doi.org/10.30765/er.2598

Abstract:

This study aims to develop a model for assessing the efficiency of Sustainable Human Resources Management (SHRM) in construction projects. A mixed-methods approach was employed to analyze the factors influencing SHRM efficiency thoroughly. In the qualitative phase, semi-structured interviews were conducted with 15 experts from the Ministry of Energy and the Ministry of Roads and Urban Development in Tehran, Iran. The interviews were analyzed using thematic and inductive thematic analysis, identifying nine key components affecting SHRM performance. These components include employee selection, training, compensation, technical management, financial management, communication, and organizational HR management, each critical to achieving sustainable outcomes in construction projects. The quantitative phase involved administering a survey to 132 experts and engineers drawn from a population of 144 professionals working on construction projects overseen by the ministries. The data collected were analyzed using Confirmatory Factor Analysis (CFA) to validate the model. The results confirmed that all identified components significantly contributed to SHRM efficiency, with high reliability and validity achieved for the model. The Analytic Hierarchy Process (AHP) was integrated into the study to refine the evaluation process further. This method allowed for prioritizing the nine components based on their relative importance, providing construction managers with a structured decision-making framework to focus on the most impactful areas for improving SHRM productivity. The study's findings offer actionable insights into managing human resources in the construction industry, emphasizing the importance of targeted HR practices in achieving sustainable project outcomes and long-term success.

1 Introduction

The concept of sustainable development, defined as creating a balance between development and the environment, has become a priority for many organizations and industries over the past few decades [1]. Sustainable development, which refers to growth that does not limit future human needs, is recognized as a fundamental strategy for human society's advancement [2]. Despite growing awareness of sustainability concerns, the application of sustainability within organizations, particularly in terms of its impact on organizational efficiency, remains underexplored [3]. Previous studies have emphasized sustainability's

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importance in organizational development, but gaps persist in understanding how different factors influence sustainable human resource management (SHRM) [4]. Human resources play a pivotal role in achieving sustainability objectives as a vital component of an organization's resources [5]. Managing human resources (HR) effectively can significantly advance an organization's sustainability goals and maximize productivity [6]. Mismanagement of these resources leads to inefficiencies, increased costs, and reduced project outcomes [7]. Therefore, improving SHRM efficiency requires industry-wide and organizational shifts toward targeted strategies that maximize resource utilization [8]. The construction industry, in particular, stands as a critical sector in sustainable development due to the vast scope and financial scale of its projects. These projects foster national development, create employment, and provide opportunities for a wide range of professionals, such as engineers, supervisors, and skilled workers [9]. Given this, human resources play an essential role in determining the success of construction projects [10]. HR management in this sector involves overseeing all employee-related functions, including recruitment, compensation, training, and performance evaluation, which are crucial to project success. However, despite this vital role, insufficient attention has been given to SHRM efficiency in construction projects [11].

This study addresses the challenges associated with SHRM productivity in the construction industry. While most research on SHRM efficiency has primarily focused on government organizations [12], limited attention has been paid to human resources in construction projects. This study seeks to bridge that gap by identifying the critical factors influencing SHRM productivity in the construction sector. The research findings aim to provide construction managers with valuable insights that can help optimize SHRM practices, thereby improving overall project outcomes from a sustainable development perspective. The primary objective of this study is to develop a comprehensive model for evaluating SHRM productivity in construction projects. A mixed-methods approach integrating qualitative and quantitative data collection was used to achieve this goal, involving interviews with industry experts and subsequent thematic analysis. Furthermore, Confirmatory Factor Analysis (CFA) was employed to validate the model, ensuring the identified components accurately reflect SHRM efficiency. The Analytic Hierarchy Process (AHP) was also incorporated into the study to enhance the decision-making framework. AHP, a widely used multi-criteria decision-making tool, allowed for systematic prioritization of the components identified during the qualitative phase [13], [14]. By employing AHP, this study identifies the most critical factors influencing SHRM productivity and ranks them in relative importance. This prioritization process offers construction managers a clear and structured approach to improving SHRM practices, enabling them to focus on the most impactful areas to enhance project performance and sustainability. The following sections review the relevant theoretical and empirical literature on sustainable development and HR management. The research methodology is outlined in detail, including the processes of expert analysis and the use of CFA for model validation. Additionally, the integration of AHP into the study is explained, highlighting how it helps prioritize SHRM factors. Finally, recommendations are provided for improving HR management performance in alignment with sustainable development objectives within the construction sector.

2 Theoretical literature and empirical background

The term "sustainability" is applied across multiple fields and is interpreted in various ways [13], [14]. Broadly, sustainability and sustainable development relate to concepts like long-term viability, resilience, and systematic approaches to achieving balanced growth [13], [14]. Sustainable development can be defined as the capacity for internal development, reinforcement, and maintenance [15]. This concept has evolved to emphasize social aspects, particularly through the lens of corporate social responsibility, leading to increased interest in sustainability concerning human resources [16]. Sustainability has long been a focus of management research, particularly concerning social and environmental dimensions [17]. However, sustainability in human resources management (HRM) is still considered an emerging concept, and much of the existing literature has yet to explore how sustainability can be fully integrated into HR practices [18]. The notion of sustainable HRM, introduced primarily by multinational corporations, includes elements such as human resource development, health, employability, and the broader role of HR in promoting organizational sustainability [19]. Although sustainability principles have been explored in strategic HRM studies (Baghdadi, 2023), gaps remain in understanding the relationship between sustainability and HRM practices. Previous studies have mostly adopted qualitative-exploratory or conceptual approaches [20], [21], offering partial insights into specific sustainability issues. However, these studies lack a comprehensive model integrating sustainability into strategic human resource management. There is a pressing need for empirical studies investigating how sustainable HR practices can influence organizational performance and productivity in different sectors.

The sustainable HRM approach is informed by sustainable work systems and strategic HRM, focusing on nurturing rather than consuming human resources [22]. This approach emphasizes employee development, reward systems, recruitment strategies, and the creation of win-win situations for both employees (e.g., through employability and career advancement) and employers (e.g., through enhanced job performance) [23]. Sustainable HRM is based on the principles of sustainable development, considering economic, social, and environmental factors while aiming to balance the needs of current employees with those of future generations [24]. Sustainable HRM functions as a cross-functional process, integrating individual responsibilities with organizational goals [25]. Scholars advocate for sustainable HRM practices during organizational change, such as downsizing, to maintain employee dignity and ensure long-term employability [26]. The theoretical foundation of sustainable HRM is drawn from stakeholder theory, self-organization theory, and competency-based perspectives [27], highlighting its dual role in benefiting both employees and employers. From an organizational perspective, sustainable HRM contributes to economic value, flexibility, and survival. It also enhances employee well-being through improved employability, work-life balance, and accountability [28]. Therefore, the overarching goal of sustainable HRM is to deploy human resources in a way that sustains and improves their long-term performance and progress while also contributing to the organization's competitive advantage [29]. Limited studies have focused on identifying the components and factors that determine the productivity of human resource management.

For example, Honary et al. [30] highlighted environmental factors such as workplace conditions, safety, and ergonomics as critical to enhancing HR productivity. Pipoli et al. [31] identified work-life balance, personal autonomy, and employability as key components of sustainable HRM. Meanwhile, studies in the public sector, like those by Ibrahim and Rahman [32], emphasized the role of non-monetary rewards and flexible work arrangements in employee retention and sustainable development. Arman [33] demonstrated that HR activities like recruitment and selection positively impact organizational performance when aligned with sustainable HRM practices. Stankeviciute and Savaneviciene [34] further highlighted that sustainable HRM practices, such as fairness, equality, and employee development, can contribute to organizational resilience. Other studies, such as those by Guerci et al. [35] and Zhang et al. [36], emphasized employee training, job satisfaction, and reduced turnover as essential components of sustainable HRM. Stanitsas et al. [8] identified 82 sustainability indicators relevant to project management in the construction industry, categorizing them into economic, environmental, and social/management groups. These findings suggest that sustainable HRM practices can significantly influence project outcomes, but further research is needed to develop specialized systems that evaluate SHRM productivity and provide improvement strategies. Despite the growing body of literature, there are still uncertainties regarding the factors influencing sustainable HRM, indicators for evaluating HRM productivity, and the potential biases in these measurements. Addressing these uncertainties is critical for developing a model to evaluate SHRM efficiency in construction projects. Ramalho et al. [37] explore the integration of Sustainable Human Resource Management (SHRM) within the supply chain in João Pessoa, Brazil, by developing and validating the SHRM_SC model. Through analysis involving 15 major construction companies and HR specialists, the study reveals that while sustainability practices in HRM are still emerging in this subsector, they show promise in areas like Health, Safety, Quality of Life at Work, and Training and Development. In another related research, Saeidi et al. [38] introduce an innovative approach to evaluating Sustainable Human Resource Management (SHRM) in manufacturing companies using an extended Pythagorean fuzzy SWARA-TOPSIS method. By integrating Stepwise Weight Assessment Ratio Analysis (SWARA) with the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), the researchers aim to classify, rank, and prioritize key SHRM factors through expert interviews and literature reviews. The framework focuses on Pythagorean Fuzzy Sets (PFSs) to address uncertainty in decision-making, particularly in the manufacturing sector of Ecuador.

The results highlight "green work-life balance" as the most critical factor, followed by corporate social responsibility and green employee relations. The study demonstrates the robustness and adaptability of the PF-SWARA-TOPSIS method for handling SHRM challenges, with sensitivity analysis affirming the model's efficacy in diverse contexts. Piwowar-Sulej [9] explored the core functions of Sustainable Human Resource Management (SHRM) through a hybrid literature review, employing the H-Classics methodology to analyze the most cited articles in the field. The study categorizes SHRM functions into recruitment and selection, performance appraisal, compensation, training and development, and HR flow, identifying training as the most widely discussed function, while HR flow remains underexplored. The research emphasizes that SHRM is primarily associated with environmental sustainability, particularly in green HRM. Finally, in a more recent study, Khalaf [39] examined the impact of Sustainable Human Resource Management (SHRM) on the performance of construction projects in Iraq, focusing on employee engagement, productivity, and communication. Through semi-structured interviews with participants from three construction firms, the research highlights the positive effects of SHRM practices such as training, work-life balance, and performance recognition. However, it also identifies challenges, including managing temporary contracts, which can affect employee stability. The study emphasizes the need for ongoing improvements in HRM processes to maximize the benefits for project outcomes in the construction industry. To this end, the following research questions are proposed:

Question 1: what are the effective factors influencing the validity and accuracy of SHRM productivity measurement, and how can measurement bias be minimized?

Answer: the study identifies nine critical factors influencing SHRM productivity, including employee selection, training, financial management, and communication. The AHP methodology ranks these factors, ensuring a systematic approach to reducing measurement bias and increasing accuracy in determining SHRM efficiency.

Question 2: how does SHRM, along with background factors, impact the determination of productivity in construction projects?

Answer: the background factors, such as organizational culture, employee experience, and the external project environment, significantly influence SHRM productivity. By using AHP, this study demonstrates how these factors can be prioritized, highlighting which background elements should receive the most attention in improving HR efficiency.

Question 3: what strategy can be employed to create a specialized system that evaluates SHRM productivity and provides improvement policies for construction projects?

Answer: integrating AHP allows for the development of a specialized decision-making framework that systematically evaluates SHRM productivity. This approach enables construction managers to focus on the most influential factors and implement targeted improvement strategies to optimize HR efficiency.

Question 4: what factors and indicators influence construction project productivity, and how can these be addressed?

Answer: the factors influencing construction project productivity include HR practices such as recruitment, training, and compensation, as well as broader sustainability indicators. The AHP analysis prioritizes these factors, providing a clear roadmap for addressing the key elements that enhance overall project productivity.

3 Research methodology

This study employed a mixed-methods approach, combining both quantitative and qualitative methodologies to provide a comprehensive understanding of the efficiency of SHRM in construction projects. This approach integrates the strengths of both methods, offering a more robust analysis than relying on either method independently [40].

3.1 Qualitative Phase

In the qualitative phase, key efficiency factors for SHRM in construction projects were identified based on previous research and expert input. Semi-structured interviews were conducted with professionals specializing in human resources and administration in construction projects. Participants were drawn from the Department of Development of Management and Human Resources at the Ministry of Energy and the Ministry of Roads and Urban Development in Tehran. The sample size for this phase was not predetermined, as purposive sampling, also known as judgmental or selective sampling, was used. This method allows researchers to select information-rich participants based on their relevance to the research objectives [41]. This study's sample included 15 individuals, 7 university professors and 8 construction project professionals. Participants were selected based on their extensive experience (over 15 years), graduate-level education or higher, and active engagement in HR roles within construction projects. The interviews continued until theoretical saturation was reached, meaning no new information or themes emerged. Data were collected through semi-structured interviews, which allowed participants to elaborate on the dimensions and components of SHRM productivity in construction projects. The interviews were then analyzed using thematic analysis with MaxQDA software.

Thematic analysis is a flexible and efficient method used to identify, analyze, and report patterns within data [42]. Clark and Braun's six-step inductive method was employed, which involved familiarizing the researcher with the data, generating initial codes, identifying and reviewing themes, defining and labeling themes, and writing reports. To ensure reliability, a subset of the interviews was coded by experienced qualitative researchers, and all initial codes were reviewed after each interview to refine the emerging themes.

3.2. Quantitative phase

The quantitative phase involved validating the themes and findings identified during the qualitative phase. This was done through a survey administered to experts in HR management in construction projects overseen by the Ministry of Energy, Ministry of Roads, and Ministry of Urban Development. The target population consisted of 144 individuals, with 132 respondents selected as the sample using non-probability sampling based on Morgan's sampling table. A 5-point Likert scale questionnaire was designed based on the themes and indicators identified during the qualitative analysis. The questionnaire aimed to measure the perceived importance and impact of the identified SHRM components on project efficiency. To ensure the reliability of the survey, Cronbach's alpha was calculated, confirming that all factors exceeded the acceptable threshold for reliability. Data analysis was conducted using R statistical software. AHP was integrated into the study to enhance the decision-making framework and provide a structured prioritization of the SHRM factors. AHP is a multi-criteria decision-making tool that allows for the systematic ranking of factors based on expert judgment.

- Hierarchy Design: the AHP model was structured in three levels:

Goal: maximize SHRM productivity in construction projects.

Criteria: the nine components identified during the qualitative phase (e.g., employee selection, training, financial management, etc.).

Sub-criteria: specific elements within each criterion that contribute to SHRM productivity.

- Pairwise comparisons: a group of HR experts and construction managers performed pairwise comparisons between the identified factors using a 9-point scale. These comparisons assessed the relative importance of one factor over another in contributing to SHRM productivity. The experts' judgments were used to rank the importance of the SHRM components.
- Consistency check: to ensure the reliability of expert judgments, the Consistency Ratio (CR) was calculated. A CR value of less than 0.10 was considered acceptable. If the CR exceeded this threshold, the comparisons were revisited and adjusted to improve consistency.
- Weight calculation: the relative weights of the nine factors were derived from the pairwise comparison data. The components with higher weights, such as employee selection, training, and financial management, were prioritized as the most critical in enhancing SHRM productivity in construction projects.
- Prioritization of factors: based on the calculated weights, the SHRM factors were ranked according to their importance. This prioritization provides a clear framework for construction managers to focus on the most impactful areas for improving SHRM practices and project efficiency.

CFA validated the themes and components identified during the qualitative and AHP phases. First- and second-order CFA was conducted to assess the significance and underlying indicators of the identified factors. The results confirmed that all factors significantly impacted SHRM productivity, with high levels of reliability and validity achieved in the model.

4 Results and findings

Data collected from 15 in-depth interviews underwent a rigorous, iterative refinement process to address the research questions. This approach enabled the progression toward more abstract conceptual levels through careful analysis and continuous comparison of semantic patterns. Following several rounds of adjustments, the final themes were developed based on feedback from both productivity experts in the construction sector and a review of the relevant literature. The refinement process ensured that the themes were grounded in the empirical data and aligned with established knowledge in the field.

For the first research question, the study focused on three specific sub-topics:

- Factors influencing the enhancement of effectiveness and efficiency in human resource activities.
- Factors affecting the accuracy of measuring human resource productivity.
- Factors contributing to deviations in the measurement of productivity in human resource activities.

These sub-topics were formulated in collaboration with experts in the field. A content analysis of the interview data identified a total of 97 key points, which were then broken down into 50 open codes and further synthesized into 12 sub-themes. These sub-themes were eventually grouped into 5 main themes, representing the overarching factors affecting human resource productivity in the construction industry. For the second research question, the analysis explored two primary sub-topics:
- The role and responsibilities of sustainable human resource management within the context of productivity measurement models in construction projects.
- Background factors that are integrated into models for determining construction project productivity.

This analysis identified 45 key points and 26 open codes, establishing 6 sub-themes, which were subsequently consolidated into 4 main themes. These themes highlight the critical elements that underpin sustainable human resource management and its influence on productivity. The third research question investigated factors related to developing specialized human resource productivity evaluation systems. Two sub-topics were addressed:
- Effective factors in creating a specialized system for evaluating productivity in human resource management in construction projects.
- Key elements in formulating policies aimed at enhancing productivity in human resource management.

The content analysis identified 76 key points and 40 open codes. These codes were refined into 9 sub-themes, further grouped into 5 main themes. These themes provide a foundation for designing systems and policies that target productivity improvements in human resource management. The fourth research question focused on identifying key factors and solutions related to human resource management that affect overall project productivity. Two sub-topics were explored:
- Factors and indicators within human resource management that influence project productivity.
- Potential solutions for enhancing productivity within construction projects.

Through the expert interviews, 40 key points and 24 open codes were derived, which were then organized into 6 sub-themes and ultimately grouped into 5 main themes. These themes serve as a basis for identifying both the challenges and strategies for improving productivity in construction projects. In summary, the iterative content analysis of the interview data resulted in identifying numerous key points, codes, sub-themes, and main themes across all research questions. This process provided a comprehensive understanding of the various factors influencing human resource productivity in the construction sector. The resulting themes address the core research questions and offer actionable insights for improving productivity through better human resource management strategies (see Table 1 for a detailed breakdown).

The final themes were carefully consolidated and organized after completing the comprehensive coding and theme identification process. This involved a systematic two-stage review and refinement process to ensure the accuracy and relevance of the identified themes. As a result, 140 open codes, 33 sub-themes, and 19 main themes were extracted from the expert interviews. These main themes were subsequently categorized into 9 overarching final themes, representing the core factors influencing human resource productivity and management in construction projects. The final themes are as follows:
- Selection, Training, and Compensation of Employees (STC): this theme focuses on the recruitment process, skill development, and compensation strategies that enhance employee performance and productivity.
- Technical Management and Use of Consultants' Technical Knowledge (TMUCK): this theme highlights the importance of integrating expert consultants' technical knowledge into project management to improve operational efficiency.
- Financial Management and Policy (FMP): this theme covers the strategic management of financial resources and the policies that govern budgeting, cost control, and financial planning concerning human resource management.
- Communication Management (CM): effective communication within teams and across organizational levels is essential for ensuring clarity, reducing misunderstandings, and enhancing collaborative efforts, all of which contribute to improved productivity.
- Organizational Management of Human Resources (OMHR): this theme examines the structural organization and administrative processes of managing human resources, including leadership roles, team dynamics, and workforce distribution.
- Accurate Operational Definition of Activity Productivity (AOD): defining productivity accurately is vital for measuring performance. This theme emphasizes the need for clear and precise operational definitions to ensure consistent and reliable productivity assessments.

- Responsible Monitoring and Evaluation (RME): ongoing monitoring and evaluation systems are crucial for tracking performance, identifying bottlenecks, and making data-driven adjustments to enhance productivity.
- Registration and Use of Updated Information (RUUI): keeping up-to-date records and utilizing current data is important for informed decision-making and adapting to changes in the project environment.
- Choosing the Best Solutions and Implementation Policies (CBSIP): this theme relates to identifying optimal solutions and policies that can be effectively implemented to address challenges and improve human resource management practices.

These 9 final themes form the foundation of a conceptual model derived from the content analysis of expert interviews. This model is designed to provide a comprehensive understanding of the key factors that influence the efficiency and sustainability of human resource management in construction projects. Figure 1 illustrates this conceptual model, visually representing the relationships between these themes and their impact on project *productivity.*

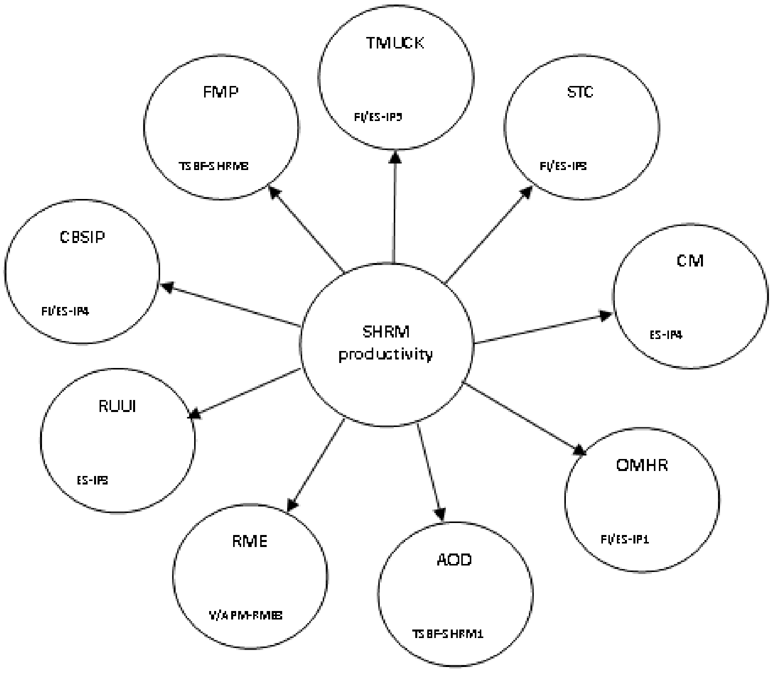

Figure 1. Conceptual model of the factors influencing the efficiency of sustainable human resources management in construction projects.

Table 1. Summary of key points, codes, sub-themes, and main themes derived from expert interviews.

Main Theme	Sub-Themes	Number of Open Codes	Number of Key Points	Minor Topics	General Topic
1. Efficient Human Resource-Driven Technical Project Management (V/APM-RMB1) 2. Comprehensive Operational Definition (V/APM-RMB2) 3. Accountable Monitoring and Evaluation Practices (V/APM-RMB3) 4. Resolution of Hardware Issues (V/APM-RMB4) 5. Clarity in Individual Goals and Tasks (V/APM-RMB5)	1. Clarity in Individual Goals and Responsibilities (VPM1) 2. Human Resources Communication Management (VPM2) 3. Technical Project Management Leveraging Human Resources (VPM3) 4. Human Resource Support Systems (VPM4)	18	40	Factors Influencing the Improvement of Efficiency and Credibility of Human Resources Activities Productivity (VPM)	Validity and Accuracy of Productivity Measurement and Reduction of Measurement Bias (V/APM-RMB)
	1. Utilizing Competent Personnel (APM1) 2. Comprehensive Operational Definitions (APM2) 3. Provision of Requisite Resources (APM3) 4. Accountable Monitoring and Evaluation (APM4)	17	32	Factors Influencing the Improvement of Accuracy in Measuring Human Resource Activities Productivity (APM)	
	1. Human Resources-Related Challenges (RMB1) 2. Accuracy-Related Challenges (RMB2) 3. Monitoring and Evaluation Challenges (RMB3) 4. Hardware Challenges (RMB4)	15	25	Factors Influencing the Deviations in Measuring Human Resource Activities Productivity (RMB)	
1. Operational Project Management (TSBF-SHRM1) 2. Communication Management (TSBF-SHRM2) 3. Financial Management and Policy Making (TSBF-SHRM3) 4. Organizational Human Resources Management (TSBF-SHRM4)	1. Project Operational Implementation (TS-SHRM1) 2. Executive Leadership (TS-SHRM2) 3. Communication Management (TS-SHRM3)	13	27	Tasks of Sustainable Human Resources Management in the Productivity Model of Construction Projects (TS-SHRM)	Background Factors in the Model of Determining the Productivity of Sustainable Human Resource Management (TSBF-SHRM)
	1. Financial Policies and Issues (BF-SHRM1) 2. Organizational Characteristics (BF-SHRM2) 3. Human Resources Characteristics (BF-SHRM3)	13	18	Background Factors in the Construction Project Productivity Determination Model (BF-SHRM)	
1. Employee Selection, Training, and Compensation (ES-IP1) 2. Leveraging Previous Project Experiences (ES-IP2) 3. Recording and Utilizing Updated Information (ES-IP3) 4. Managing Employee Communication (ES-IP4) 5. Project Cost Allocation and Employee Productivity (ES-IP5)	1. Utilizing Experts and Valid Analyses (ES1) 2. Planning for Employee Selection, Training, and Compensation (ES2) 3. Job Experience and Work Environment (ES3) 4. Recording and Utilizing Updated Information (ES4) 5. Managing Employee Communication (ES5)	25	46	Factors Influencing Creating a Specialized System to Evaluate Productivity in Human Resources Management of Construction Projects (ES)	Expert System to Evaluate Productivity and Improvement Policy (ES-IP)
	1. Leveraging Previous Project Experiences (IP1) 2. Upholding Organizational Culture Based on Job Security and Hierarchy (IP2) 3. Project Expenditure and Employee Productivity (IP3) 4. Selecting Experienced and Machine-Savvy, Committed Managers and Employees (IP4	15	30	Factors Influencing Creating a Specialized System to Develop Policies for Improving Productivity in Human Resources Management of Construction Projects (IP)	

Table 1. Continue.

Main Theme	Sub-Themes	Number of Open Codes	Number of Key Points	Minor Topics	General Topic
1. Organizational Management of Human Resources (FI/ES-IP1) 2. Financial Management of Human Resources (FI/ES-IP2) 3. Training of Executives and Managers (FI/ES-IP3) 4. Selecting Optimal Solutions and Implementation Policies (FI/ES-IP4) 5. Leveraging the Technical Knowledge of Consultants and Officials (FI/ES-IP5)	1. Organizational Management of Human Resources (FIAP1) 2. Financial Management of Human Resources (FIAP2)	12	31	Factors and Indicators of Human Resource Management Affecting Project Productivity (FIAP)	Factors and Indicators Affecting Productivity and Executive Solutions to Improve Productivity (FI/ES-IP)
	1. Training of Executives and Managers (ESIP1) 2. Selecting Optimal Solutions and Executive Policies (ESIP2) 3. Improving Administrative Systems (ESIP3) 4. Leveraging the Technical Knowledge of Consultants and Officials (ESIP4)	12	19	Access to Executive Policies for Improving Project Productivity (ESIP)	

A comprehensive questionnaire was developed by consolidating the initial 19 main themes into 9 final themes, ensuring a streamlined yet thorough evaluation framework. This questionnaire was designed specifically to assess the impact of these 9 final themes on human resource management practices in the construction sector. The questionnaire's content was carefully crafted, with each theme evaluated through 5 key points identified during the content analysis and subsequently validated by experts in the field. These key points served as the basis for a deeper exploration of each theme, ensuring that the questionnaire captured the nuances and complexities of the factors affecting human resource productivity and management. The questionnaire was then distributed among human resource managers in the construction industry. These professionals were selected for their hands-on experience and insight into the practical application of human resource management strategies. Their feedback provided valuable data to assess how the identified themes influence HR practices, decision-making, and overall project productivity. Each of the 9 final themes was evaluated on multiple dimensions, allowing for a comprehensive assessment of its relevance and impact. The 5 key points for each theme provided a structured approach to understanding the specific aspects of human resource management, such as employee selection and training, communication strategies, financial management, and the integration of technical knowledge. Table 2 presents this questionnaire's descriptive statistics and reliability indicators, providing an overview of how the instrument performed consistently and accurately. The reliability measures, such as Cronbach's alpha, demonstrate the internal consistency of the questionnaire, ensuring that the themes were assessed reliably across different respondents. Descriptive indicators, including mean and standard deviation, offer insights into the distribution of responses, highlighting the degree to which HR managers in the construction sector agree or differ in their evaluation of the 9 final themes.

Table 2. Descriptive statistics of factors.

Factors	AVG	MED	STD	MIN	MAX	Cronbachs'Alpha
FMP	3.556061	3.60	0.723146	1.40	5.00	0.876
CBSIP	3.05303	3.00	0.760819	1.40	4.80	0.889
RUUI	3.118182	3.20	0.832528	1.20	4.80	0.902
RME	3.509091	3.60	0.700431	1.40	4.80	0.861
AOD	3.359091	3.40	0.72963	1.40	5.00	0.861
OMHR	3.737879	3.80	0.721801	1.80	5.00	0.858
CM	2.498485	2.60	0.805135	1.00	4.80	0.898
STC	3.930303	4.00	0.722162	2.00	5.00	0.880
TMUK	2.757576	2.80	0.812885	1.00	4.40	0.890

The results presented in Table 2 demonstrate that Cronbach's alpha for all model components exceeds the threshold of 0.7, indicating that the research questionnaire is highly reliable for the quantitative analysis phase. This high level of reliability ensures that the questionnaire consistently measures the intended components across various respondents, supporting the robustness of the data collected. Furthermore, the average scores attained for each component reflect the degree of consensus among experts and human resource managers in the construction sector regarding the importance of these components in determining the productivity of sustainable human resource management. These scores provide critical insights into how each theme is perceived in terms of its impact on productivity. An analysis of the average scores reveals an important finding: while most components of the model were rated above the neutral score of 3, two components, i.e., Communication Management (CM) and Registration and Use of Updated Information (RUUI), received ratings lower than 3, suggesting that managers perceive these areas as weaker or less influential in enhancing productivity within their current practices. This discrepancy highlights potential areas for improvement or further investigation, as the lower ratings might indicate challenges or gaps in implementing effective communication strategies and utilizing up-to-date information in the sector. On the other hand, the remaining components were consistently rated above 3, underscoring their recognized importance in sustainable human resource management productivity. These components, such as Selection, Training, and Compensation (STC) and Responsible Monitoring and Evaluation (RME), are evidently regarded as critical by HR managers for optimizing workforce performance in construction projects. Both first-order and second-order confirmatory factor analyses (CFA) were conducted to validate further the initial conceptual model derived from content analysis. These analyses tested the strength of the relationships between the identified indicators and the model's broader components, confirming the proposed framework's structural validity. The first-order CFA results, as detailed in Table 3, provide insights into the individual factors influencing the productivity of sustainable human resource management in construction projects. These results offer a detailed examination of how well each factor aligns with the overall model. It serves as a foundation for the second-order analysis, which evaluates the hierarchical relationships among the broader themes and their sub-components.

Table 3. First-order confirmatory factor analysis.

SHRM Factors	Estimate	Std	Z-Statistic	P-Value
FMP	1.00	0.580	0.580	
CBSIP	1.20	0.298	4.016	0.000
RUUI	1.51	0.336	4.512	0.000
RME	1.79	0.371	4.829	0.000
AOD	1.82	0.375	4.858	0.000
OMHR	1.45	0.329	4.401	0.000
CM	1.90	0.395	4.800	0.000
STC	1.24	0.270	4.596	0.000
TMUK	1.67	0.357	4.682	0.000

According to the results shown in Table 3, the significance levels for all model components are below 0.05, highlighting the statistical significance of these components in explaining the factors that contribute to the productivity of sustainable human resource management. This underscores the relevance of each component in the model and supports their inclusion in the conceptual framework for understanding HR productivity in the construction sector.

In this analysis, the Financial Management and Policy (FMP) factor has been designated as the reference factor, with its factor loading set to 1. This means that the significance and importance of all other factors are measured relative to this reference factor. Consequently, the significance level for the FMP factor itself has not been calculated, as it serves as the baseline against which other factors are evaluated.

The model's fit to the data has been assessed using several goodness-of-fit indices, all indicating a favorable fit. Specifically:

- The Comparative Fit Index (CFI) value of 0.965 suggests that the model provides an excellent fit to the data, as values above 0.95 are typically considered a strong indication of good model fit.

- The Tucker-Lewis Index (TLI) value of 0.963 further supports this, as it also exceeds the 0.95 threshold, reinforcing the robustness of the model.
- The Chi-Square/df statistic ratio of approximately 4 is within the acceptable range, indicating a reasonable fit between the model and the observed data.

  Moreover, the error indices, including the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR), also demonstrate that the model's errors are within acceptable limits. Specifically:
- The RMSEA value of 0.031 is well below the conventional cutoff of 0.08, suggesting a close approximation between the model and the data.
- The SRMR value of 0.063 also falls within the acceptable range, further confirming that the model's residuals are minimal.

These goodness-of-fit indices, widely considered crucial in evaluating model adequacy in confirmatory factor analysis, collectively affirm that the model fits the data well. This strong model fit indicates that the identified factors effectively explain the productivity of sustainable human resource management in the construction industry. Table 4 provides the second-order confirmatory factor analysis results, which evaluate the relationships between the broader factors and their associated indicators. This second-order analysis further validates the structural relationships in the model, confirming the hierarchical nature of the factors influencing HR productivity and their interconnections.

Table 4. Second-order confirmatory factor analysis.

SHRM Factors	Index	Estimate	Std	Z-Statistic	P-Value
FMP	FMP1	1.000	0.527	0.744	
	FMP2	1.480	0.155	9.532	0.000
	FMP3	1.676	0.170	9.846	0.000
	FMP4	1.488	0.170	8.733	0.000
	FMP5	0.814	0.110	7.394	0.000
CBSIP	CBSIP1	1.000	0.723	0.794	
	CBSIP2	0.898	0.101	8.885	0.000
	CBSIP3	1.079	0.108	9.975	0.000
	CBSIP4	1.012	0.106	9.566	0.000
	CBSIP5	0.956	0.098	9.710	0.000
RUUI	RUUI1	1.000	0.732	0.754	
	RUUI2	0.966	0.104	9.321	0.000
	RUUI3	1.189	0.119	9.987	0.000
	RUUI4	1.072	0.114	9.410	0.000
	RUUI5	1.158	0.119	9.697	0.000
RME	RME1	1.000	0.738	0.760	
	RME2	0.884	0.098	9.060	0.000
	RME3	0.747	0.103	7.277	0.000
	RME4	0.805	0.096	8.351	0.000
	RME5	0.963	0.106	9.092	0.000
AOD	AOD1	1.000	0.773	0.807	
	AOD2	0.824	0.100	8.275	0.000
	AOD3	0.875	0.094	9.327	0.000
	AOD4	0.883	0.093	9.464	0.000
	AOD5	0.782	0.100	7.829	0.000
OMHR	OMHR1	1.000	0.718	0.750	
	OMHR2	1.116	0.127	8.765	0.000
	OMHR3	1.115	0.127	8.767	0.000
	OMHR4	0.751	0.086	8.776	0.000
	OMHR5	0.679	0.096	7.092	0.000

Table 4. Continue.

SHRM Factors	Index	Estimate	Std	Z-Statistic	P-Value
CM	CM1	1.000	0.844	0.812	
	CM2	0.911	0.078	11.656	0.000
	CM3	0.886	0.090	9.892	0.000
	CM4	0.881	0.084	10.511	0.000
	CM5	0.825	0.090	9.155	0.000
	STC1	1.000	0.565	0.740	
	STC2	1.059	0.120	8.794	0.000
STC	STC3	1.169	0.127	9.183	0.000
	STC4	1.442	0.165	8.764	0.000
	STC5	1.328	0.152	8.742	0.000
	TMUK1	1.000	0.767	0.795	
	TMUK2	1.095	0.107	10.268	0.000
TMUK	TMUK3	1.037	0.107	9.689	0.000
	TMUK4	0.976	0.108	9.058	0.000
	TMUK5	0.871	0.091	9.554	0.000

The results from the second-order confirmatory factor analysis indicate that all indicators used to measure the factors influencing the productivity of sustainable human resource management made significant contributions, as their significance levels are below the 0.05 threshold. This demonstrates that each indicator plays a crucial role in explaining the respective factors within the model. In the analysis, a reference index was designated for each factor, and the significance of the other indices was evaluated in relation to this reference. By comparing the factor loadings of the other indices with the reference index, the analysis confirmed that all indices are valid and important contributors to their corresponding factors. These findings support the robustness and comprehensiveness of the model. The significant contributions of all indicators suggest that the model accurately captures the various dimensions affecting sustainable human resource productivity in the construction sector. Based on these results, the final conceptual model for determining the productivity of sustainable human resource management in construction can be depicted in Figure 2. This model visually represents the relationships between the identified factors and their corresponding indicators, illustrating how each factor contributes to the overall productivity framework. The model serves as a practical tool for understanding the key drivers of HR productivity and can guide decision-making in construction projects focused on sustainable management practices.

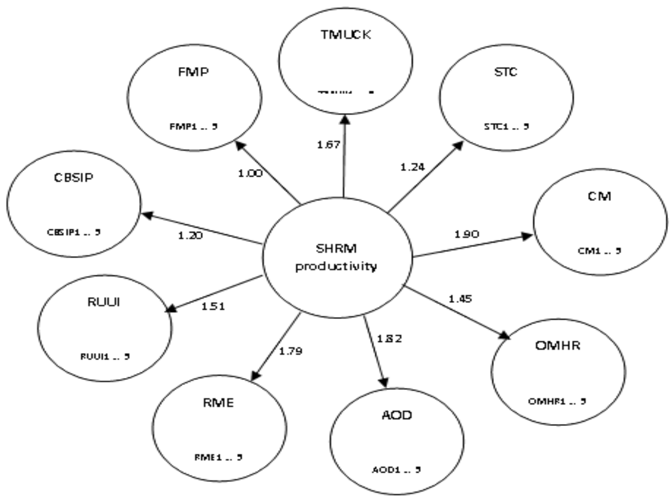

Figure 2. Model of determining the efficiency of SHRM in construction projects.

To assess the relative importance of the factors influencing Sustainable Human Resource Management (SHRM) efficiency in construction projects, the Analytic Hierarchy Process (AHP) was employed. This structured decision-making method utilizes expert judgments to perform pairwise comparisons of the factors, allowing for a systematic evaluation of their relative importance. The process involves the following steps:

Pairwise comparison matrix

A group of experts was asked to compare each pair of the nine SHRM factors using a 9-point scale. This scale is commonly used in AHP and ranges from 1 (indicating equal importance) to 9 (indicating extreme importance of one factor over another). The experts' judgments were consolidated to create a pairwise comparison matrix**,** which forms the foundation for calculating the priority weights of each factor. Below is a hypothetical example of such a pairwise comparison matrix for the nine SHRM factors:

Factor	**STC**	**FMP**	**TMUCK**	**OMHR**	**RME**	**AOD**	**CBSIP**	**RUUI**	**CM**
STC	1	3	5	7	9	8	7	6	9
FMP	1/3	1	4	5	7	6	5	4	7
TMUCK	1/5	1/4	1	3	5	4	3	3	5
OMHR	1/7	1/5	1/3	1	3	2	2	2	3
RME	1/9	1/7	1/5	1/3	1	1	1	1	2
AOD	1/8	1/6	1/4	1/2	1	1	1	1	2
CBSIP	1/7	1/5	1/3	1/2	1	1	1	1	2
RUUI	1/6	1/4	1/3	1/2	1	1	1	1	2
CM	1/9	1/7	1/5	1/3	1/2	1/2	1	1	1

Normalization of the pairwise comparison matrix

The pairwise comparison matrix was normalized to calculate the relative priority weights for each factor influencing Sustainable Human Resource Management (SHRM) efficiency. This was done by dividing each element of the matrix by the sum of its respective column, ensuring that the total sum of each column is 1. The row averages were then computed to determine the priority weight of each factor. The normalized matrix and the corresponding row averages (priority weights) are as follows:

Factor	STC	FMP	TMUCK	OMHR	RME	AOD	CBSIP	RUUI	CM	Row Average (Priority Weight)
STC	0.32	0.36	0.35	0.29	0.28	0.28	0.26	0.25	0.30	0.302
FMP	0.11	0.12	0.28	0.21	0.22	0.21	0.19	0.16	0.23	0.196
TMUCK	0.06	0.03	0.07	0.13	0.16	0.14	0.11	0.12	0.17	0.110
OMHR	0.04	0.02	0.02	0.04	0.10	0.07	0.07	0.08	0.10	0.060
RME	0.03	0.01	0.02	0.01	0.05	0.07	0.07	0.05	0.07	0.040
AOD	0.04	0.02	0.03	0.02	0.05	0.05	0.05	0.05	0.07	0.040
CBSIP	0.04	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.07	0.037
RUUI	0.05	0.02	0.03	0.03	0.05	0.05	0.05	0.05	0.07	0.040
CM	0.03	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.018

The priority weights for each factor were derived by averaging the normalized values across each row. These priority weights provide a quantitative ranking of the factors based on their relative importance in improving SHRM efficiency.
The results from the Analytic Hierarchy Process (AHP) analysis reveal the following final ranking:

- Employee Selection, Training, and Compensation (STC) – 0.302. This factor is rated as the most important, emphasizing the critical role that proper employee selection, development, and compensation play in improving SHRM efficiency.
- Financial Management and Policy (FMP) – 0.196. Effective financial management is considered the second most important factor, reflecting its role in ensuring resources are allocated to support HR initiatives.
- Technical Management and Use of Knowledge (TMUCK) – 0.110. The use of technical expertise and consultants' knowledge is ranked third, highlighting the value of integrating technical skills into HR processes.

- Organizational Management of Human Resources (OMHR) – 0.060. Managing the organizational structure of HR, including leadership and workforce allocation, is also important but ranks fourth in priority.
- Responsible Monitoring and Evaluation (RME) – 0.040. The continuous monitoring and evaluation of HR activities rank fifth, signaling the importance of oversight in maintaining HR efficiency.
- Accurate Operational Definition of Productivity (AOD) – 0.040. Tied with RME, the precise definition and measurement of productivity are essential for evaluating HR performance.
- Choosing Best Solutions and Implementation Policies (CBSIP) – 0.037. This factor, though important, ranks lower, suggesting that while policy choices are key, other factors may have more immediate impacts.
- Registration and Use of Updated Information (RUUI) – 0.040. Maintaining and utilizing current data is important to RME and AOD, reflecting its role in informed decision-making.
- Communication Management (CM) – 0.018. Communication management, though essential, is ranked last, possibly indicating that while it is important, it is less of a direct contributor to SHRM efficiency compared to other factors.

Consistency Check

The Consistency Ratio (CR) was calculated to ensure that the expert judgments were consistent. The calculation was as follows:

- Consistency Index (CI) = (λ_{max}- n) / (n - 1), where λ_{max} is the largest eigenvalue, and n is the number of criteria.
- CR = CI / RI (Random Index).

Let's assume that the CR was calculated and found to be 0.06, well below the threshold of 0.1. Therefore, the judgments made by the experts were consistent, and the AHP results were reliable.

The AHP analysis has produced insightful results highlighting the relative importance of various SHRM components. Employee Selection, Training, and Compensation (STC) emerged as the most influential, with a weight of 0.302. This result underscores the critical importance of having the right personnel and the need for continuous training and appropriate compensation strategies to motivate and retain employees in construction projects. Financial Management and Policy (FMP) ranked second, weighing 0.196. This demonstrates the need for effective financial planning and budget control to ensure the smooth running of construction projects and to support HR initiatives. Technical Management and Use of Knowledge (TMUCK) ranked third, with a weight of 0.110, highlighting the role of technical expertise and knowledge-sharing in driving project success. On the other hand, Communication Management (CM) received the lowest priority, with a weight of 0.018. While communication remains an important aspect of any organization, it was deemed less critical than other SHRM factors. Communication processes may be already well-established in construction projects, hence receiving less focus from the experts.

5 Conclusion

This research aimed to develop a comprehensive model for assessing Sustainable Human Resource Management (SHRM) productivity in construction projects. The findings from the qualitative analysis identified nine key components that significantly influence SHRM productivity in the construction sector. These components are:

- Selection, Training, and Compensation of Employees
- Technical Management and Utilization of Consultants' Technical Knowledge
- Financial Policy and Management
- Communication Management
- Organizational Management of Human Resources
- Accurate Operational Definition of Activity Productivity
- Responsible Monitoring and Evaluation
- Registration and Use of Updated Information
- Choosing the Best Solutions and Implementation Policies

The evaluation of the model using Confirmatory Factor Analysis (CFA) confirmed that all identified factors achieved statistical significance, collectively offering a robust explanation of SHRM productivity in construction projects. Consequently, the nine factors and their associated 45 indicators can be effectively employed in assessing SHRM productivity within this context.

In addition to the CFA, the Analytic Hierarchy Process (AHP) was employed to prioritize and rank these factors. The AHP analysis revealed that employee selection, training, and compensation were the most critical factors influencing SHRM efficiency, followed by financial policy and management, technical management, and consultants' technical knowledge utilization. Conversely, Communication Management was ranked as the least influential factor. These insights provide a clear hierarchy of factors, aiding decision-makers in focusing on the most impactful areas for improving SHRM efficiency in construction projects. While identifying and validating these factors through a mixed-method approach is significant, it is important to recognize that this model was developed within the specific context of the construction industry. Therefore, its applicability to other industries should be further examined. Future research in different sectors is recommended to assess the model's generalizability and explore whether similar factors and rankings hold in other fields. The most notable contribution of this study is its exploratory approach, which employed content analysis to identify the factors that influence SHRM productivity. This approach has led to discovering factors not considered in prior studies, particularly within the construction industry. Additionally, this research represents one of the pioneering investigations into sustainable human resource management efficiency in Iran's construction sector, offering new insights and paving the way for further studies. It is suggested that more extensive and in-depth quantitative studies be conducted based on the factors and components identified in this research. Such studies would provide clearer, data-driven insights into each factor's specific role in determining SHRM productivity, further advancing the understanding of sustainable HR practices in construction and other industries.

References

[1] M. R. Islam, A. M. Mahfuz-Ur-Rahman, K. M. Muttaqi, and D. Sutanto, "State-of-the-art of the medium-voltage power converter technologies for grid integration of solar photovoltaic power plants," *IEEE Trans. Energy Convers.*, vol. 34, no. 1, pp. 372–384, 2018, [Online]. Available: https://ieeexplore.ieee.org/abstract/document/8516356/

[2] D. Rahadian *et al.*, "An Evaluation of E7 Countries' Sustainable Energy Investments: A Decision-Making Approach with Spherical Fuzzy Sets," *Economics*, vol. 17, no. 1, p. 20220051, 2023, [Online]. Available: https://www.degruyter.com/document/doi/10.1515/econ-2022-0051/html

[3] F. Parvaresh and M. H. Amini, "Application of circular economy for sustainable waste management in the carpet industry," *Int. J. Res. Ind. Eng.*, vol. 13, no. 2, pp. 188–206, 2024, [Online]. Available: https://www.riejournal.com/article_193185.html

[4] A. Rasulov, N. Alimkulov, and U. Safarov, "THE ROLE OF GEOECOLOGICAL INDICATORS IN THE SUSTAINABLE DEVELOPMENT OF AREAS," *J. Pharm. Negat. Results*, pp. 6498–6501, 2022.

[5] M. Imeni and A. Sorourkhah, "Procrustes' bed metaphor; understanding the problem of creativity and innovation in the human resources of Iran's state-owned enterprises," *Innov. Manag. Oper. Strateg.*, vol. 4, no. 3, pp. 208–218, 2023, [Online]. Available: https://www.journal-imos.ir/article_162706_fbcea64ad84bb69834e4647a37b36edc.pdf

[6] S. M. Ghanizadeh, "Human resource evaluation using a GRA-based decision model in an interval-valued fuzzy environment," *J. Decis. Oper. Res.*, vol. 9, no. 1, pp. 134-148. (In Persian), 2024, doi: 10.22105/dmor.2024.402960.1767.

[7] N. Klimovskikh, V. Sekerin, S. Makushkin, A. Kuzmicheva, M. Leontev, and E. Kochetkov, "Impact of human resource management on improving the innovation potential of an enterprise to achieve the principles of sustainable development," *J. Law Sustain. Dev.*, vol. 11, no. 1, pp. e0274–e0274, 2023, [Online]. Available: https://journalsdg.org/jlss/article/view/274

[8] M. Stanitsas, K. Kirytopoulos, and V. Leopoulos, "Integrating sustainability indicators into project management: The case of construction industry," *J. Clean. Prod.*, vol. 279, p. 123774, 2021, doi: 10.1016/j.jclepro.2020.123774.

[9] K. Piwowar-Sulej, "Core functions of Sustainable Human Resource Management. A hybrid literature review with the use of H-Classics methodology," *Sustain. Dev.*, vol. 29, no. 4, pp. 671–693, 2021, [Online]. Available: https://onlinelibrary.wiley.com/doi/abs/10.1002/sd.2166

[10] S. S. Darvazeh, F. M. Mooseloo, S. Aeini, H. R. Vandchali, and E. B. Tirkolaee, "An integrated

methodology for green human resource management in construction industry," *Environ. Sci. Pollut. Res.*, vol. 30, no. 60, pp. 124619–124637, 2023, [Online]. Available: https://link.springer.com/article/10.1007/s11356-022-20967-8

[11] W. Widyanty, A. Daito, S. Riyanto, and D. Nusraningrum, "Gaining a competitive advantage through strategic human resource management in Indonesian construction industry," *Manag. Sci. Lett.*, vol. 10, no. 9, pp. 2021–2028, 2020, [Online]. Available: http://m.growingscience.com/beta/msl/3732-gaining-a-competitive-advantage-through-strategic-human-resource-management-in-indonesian-construction-industry.html

[12] A. T. Gurmu and C. S. Ongkowijoyo, "Predicting construction labor productivity based on implementation levels of human resource management practices," *J. Constr. Eng. Manag.*, vol. 146, no. 3, p. 4019115, 2020, [Online]. Available: https://ascelibrary.org/doi/abs/10.1061/(ASCE)CO.1943-7862.0001775

[13] K. Fahimi, A. J. Shahrestani, A. R. Zamaninejad, and F. Kaboli, "Proposing a Performance Assessment Model for the Tehran Municipality Using TOPSIS and AHP," *J. Appl. Res. Ind. Eng. Vol*, vol. 11, no. 2, pp. 298–317, 2024, [Online]. Available: https://www.journal-aprie.com/article_194003_5469d2a28ad820e7ab3576ca907b0903.pdf

[14] R. Barati and S. Fanati Rashidi, "Fuzzy AHP and fuzzy TOPSIS synergy for ranking the factor influencing employee turnover intention in the Iran hotel industry," *J. Appl. Res. Ind. Eng.*, vol. 11, no. 1, pp. 57–75, 2024, [Online]. Available: https://www.journal-aprie.com/article_153852.html

[15] Y. Zhang, M. Imeni, and S. A. Edalatpanah, "Environmental dimension of corporate social responsibility and earnings persistence: an exploration of the moderator roles of operating efficiency and financing cost," *Sustainability*, vol. 15, no. 20, p. 14814, 2023, [Online]. Available: https://www.mdpi.com/2071-1050/15/20/14814

[16] A. Sadeghi, M. Khodabakhshi, and Z. M. Ghasemi, "The Impact of Technology Orientation on Export Per-formance with Emphasis on the Mediating Role of Innovation and Moderating Role of Corporate Social Responsibility," *Innov. Manag. Oper. Strateg.*, vol. 2, no. 3, pp. 268–284, 2021, [Online]. Available: https://www.journal-imos.ir/article_140270_dcb4d4f5c453667c05aadbb3acd540d5.pdf

[17] T. C. Abreu, J. W. J. Beulens, F. Heuvelman, L. J. Schoonmade, and J. D. Mackenbach, "Associations between dimensions of the social environment and cardiometabolic health outcomes: a systematic review and meta-analysis," *BMJ Open*, vol. 14, no. 8, p. e079987, 2024, [Online]. Available: https://bmjopen.bmj.com/content/14/8/e079987.abstract

[18] S. S. Mehak and H. M. Batcha, *Analyzing the influence of green human resource practices on organizational sustainability: the role of green attitudes and performance of employees'*. Springer, 2024. [Online]. Available: https://link.springer.com/article/10.1007/s10668-024-05157-5

[19] A. Heravi, A. Zamani Moghadam, S. A. Hashemi, Y. Vakil Alroaia, and A. Sajadi Jagharg, "Evaluation of the influential factors in human resource development in state-owned enterprises using a mixed method," *J. Appl. Res. Ind. Eng.*, vol. 10, no. 2, pp. 238-255. (in prsian), 2023, [Online]. Available: https://www.journal-aprie.com/article_138884.html

[20] S. Soltanieh and N. Sheikholeslami Kandelousi, "Investigating the Effect of High-Performance Work Systems on Organizational Performance with the Mediating Role of Organizational Ambivalence (Case Study: Ayandeh Bank in Tehran)," *Mod. Res. Perform. Eval.*, vol. 2, no. 3, pp. 157-167. (in persian), 2023, doi: 10.22105/mrpe.2024.186629.

[21] O. S. Onyekwere, A. Haruna, and A. Azodo, "Mitigating Human Error in Oil and Gas Accidents using TRACEr-OGI: A Middle Eastern Case Study," *Risk Assess. Manag. Decis.*, vol. 1, no. 1, pp. 22–40, 2024, [Online]. Available: https://ramd.reapress.com/journal/article/view/25

[22] A. Karman, "Understanding sustainable human resource management–organizational value linkages: The strength of the SHRM system," *Hum. Syst. Manag.*, vol. 39, no. 1, pp. 51–68, 2020, [Online]. Available: https://content.iospress.com/articles/human-systems-management/hsm190602

[23] K. U. Rehman, M. N. Mata, J. M. Martins, S. Mariam, J. X. Rita, and A. B. Correia, "SHRM practices employee and organizational resilient behavior: Implications for open innovation," *J. Open Innov. Technol. Mark. Complex.*, vol. 7, no. 2, p. 159, 2021, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2199853122009283

[24] A. Gamage, J. Pyke, and T. de Lacy, "Building resilience and sustainable HRM in the visitor economy: An uneasy relationship," *J. Hosp. Tour. Manag.*, vol. 58, pp. 497–505, 2024, [Online]. Available:

https://www.sciencedirect.com/science/article/pii/S1447677023000736
[25] E. Yakut and E. Kara, "Determining role of employee empowerment and perceived organizational support in the effect of shrm on job satisfaction and turnover intention," *Ege Acad. Rev.*, vol. 22, no. 1, pp. 17–31, 2021, [Online]. Available: https://dergipark.org.tr/en/pub/eab/article/1059836
[26] N. Thom and C. Schupbach-Bronnimann, *Personalmanagement in Zeiten steter Veranderungen: Bestandigkeit durch Nachhaltigkeit*. Rainer Hampp Verlag, 2003. [Online]. Available: https://boris.unibe.ch/101210/
[27] N. Thom and R. J. Zaugg, "Das Prinzip Nachhaltigkeit im Personalmanagement," *Personalfuhrung*, pp. 52–55, 2002, [Online]. Available: https://www.researchgate.net/profile/Norbert-Thom/publication/269709349_Das_Prinzip_Nachhaltigkeit_im_Personalmanagement_Ausgewahlte_Ergebnisse_einer_Befragung_in_europaischen_Unternehmen_und_Institutionen/links/54947e280cf29b944820616f/Das-Prinzip-Nachhaltigkeit-im-Personalmanagement-Ausgewaehlte-Ergebnisse-einer-Befragung-in-europaeischen-Unternehmen-und-Institutionen.pdf
[28] G. Uysal, "Implementation of SHRM in organizations through strategic HR directors," *J. Manag. Econ. Stud.*, vol. 4, no. 2, pp. 135–145, 2022, [Online]. Available: https://www.jomaes.org/index.php/jomaes/article/view/81
[29] N. Thom and R. J. Zaugg, "Sustainable and innovative human resources management: Top group survey in European companies and institutions," in *Sustainable innovation management*, Springer, 2004, pp. 215–245. [Online]. Available: https://link.springer.com/chapter/10.1007/978-3-663-10862-7_11
[30] H. Honary, A. Rezaeian, H. Kouzecheian, and M. Ehsani, "Relation between motivation & productivity of human resources in body training organizations," *J. Spring Mov.*, vol. 27, no. 1, pp. 106–123, 2006.
[31] G. Pipoli, R. M. Fuchs, and M. A. Prialé, "Sustainable HRM in Peruvian Companies: An Exploratory Study," in *Sustainability and Human Resource Management: Developing Sustainable Business Organizations*, Springer, 2013, pp. 359–377. [Online]. Available: https://link.springer.com/chapter/10.1007/978-3-642-37524-8_16
[32] N. S. Ibrahim and R. A. Rahman, "Sustainable human resource management practices in the Malaysian public sector: An exploratory study," *Int. J. Acad. Res. Bus. Soc. Sci.*, vol. 7, no. 4, pp. 1124–1137, 2017, [Online]. Available: https://www.academia.edu/download/92042178/a1b93a21ad3cb85bed66985e998ce4f73b63.pdf
[33] S. M. Arman, "Impact of sustainable human resource management in organizational performance: A study on Bangladeshi HR professionals," in *Proceedings of 15th Asian business research conference*, 2017, pp. 22–23. [Online]. Available: https://www.researchgate.net/profile/Saleh-Arman/publication/322095789_Impact_of_Sustainable_Human_Resource_Management_in_Organizational_Performance_A_Study_on_Bangladeshi_HR_Professionals/links/5a449f18a6fdcce19718ecd5/Impact-of-Sustainable-Human-Resource-Management-in-Organizational-Performance-A-Study-on-Bangladeshi-HR-Professionals.pdf
[34] Z. Stankevioiute and A. Savaneviciene, "Designing sustainable HRM: The core characteristics of emerging field," *Sustainability*, vol. 10, no. 12, p. 4798, 2018, [Online]. Available: https://www.mdpi.com/2071-1050/10/12/4798
[35] M. Guerci, A. Decramer, T. Van Waeyenberg, and I. Aust, "Moving beyond the link between HRM and economic performance: A study on the individual reactions of HR managers and professionals to sustainable HRM," *J. Bus. ethics*, vol. 160, pp. 783–800, 2019, [Online]. Available: https://link.springer.com/article/10.1007/s10551-018-3879-1
[36] L. Zhang, X. Guo, Z. Lei, and M. K. Lim, "Social network analysis of sustainable human resource management from the employee training's perspective," *Sustainability*, vol. 11, no. 2, p. 380, 2019, [Online]. Available: https://www.mdpi.com/2071-1050/11/2/380
[37] T. Silveira Ramalho and M. de Fátima Martins, "Sustainable Human Resource Management in the Supply Chain: A new framework," *Clean. Logist. Supply Chain*, vol. 5, p. 100075, 2022, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2772390922000488
[38] P. Saeidi, A. Mardani, A. R. Mishra, V. E. Cajas Cajas, and M. G. Carvajal, "Evaluate sustainable human resource management in the manufacturing companies using an extended Pythagorean fuzzy SWARA-TOPSIS method," *J. Clean. Prod.*, vol. 370, p. 133380, 2022, doi: 10.1016/j.jclepro.2022.133380.

[39] A. Khalaf, “EXPLORING THE IMPACT OF SUSTAINABLE HUMAN RESOURCES MANAGEMENT ON THE EFFICIENCY AND EFFECTIVENESS OF CONSTRUCTION PROJECTS: THE CASE OF IRAQ,” *Int. J. Stud. Bus. Manag. Econ. Strateg.*, vol. 3, pp. 145–175, 2024, [Online]. Available: https://www.researchgate.net/publication/385385361_EXPLORING_THE_IMPACT_OF_SUSTAINABLE_HUMAN_RESOURCES_MANAGEMENT_ON_THE_EFFICIENCY_AND_EFFECTIVENESS_OF_CONSTRUCTION_PROJECTS_THE_CASE_OF_IRAQ

[40] R. B. Johnson and A. J. Onwuegbuzie, “Mixed methods research: A research paradigm whose time has come,” *Educ. Res.*, vol. 33, no. 7, pp. 14–26, 2004, [Online]. Available: https://journals.sagepub.com/doi/abs/10.3102/0013189x033007014

[41] A. E. Berndt, “Sampling methods,” *J. Hum. Lact.*, vol. 36, no. 2, pp. 224–226, 2020, [Online]. Available: https://journals.sagepub.com/doi/abs/10.1177/0890334420906850

[42] J. Xu and W. B. Croft, “Improving the effectiveness of information retrieval with local context analysis,” *ACM Trans. Inf. Syst.*, vol. 18, no. 1, pp. 79–112, 2000, [Online]. Available: https://dl.acm.org/doi/abs/10.1145/333135.333138