



Sustainable Development through Science, Engineering and Technology: An Empirical Human Resource Management Perspective in the Viksit Bharat Context

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Abstract

Sustainable development has become a cornerstone of India's national agenda under the *Viksit Bharat* vision. While science, engineering, and technology (SET) provide the technical foundation for sustainability, Human Resource Management (HRM) plays a crucial but often overlooked role in embedding and scaling sustainable practices. This study empirically investigates how HRM strategies—particularly green HRM, continuous skill development, and employee engagement—shape sustainability outcomes in engineering and technology-driven organizations. Survey data from 210 employees across institutions and firms were analyzed using descriptive statistics, reliability checks, correlation, and regression techniques. Results confirm that HRM practices significantly predict sustainability performance, positioning HRM as a strategic enabler of sustainable development in the SET context aligned with *Viksit Bharat*.

Keywords: Sustainable HRM, Green HRM, Viksit Bharat, Engineering Organizations, Empirical Study

Introduction

India's *Viksit Bharat* vision emphasizes inclusive growth, technological independence, and sustainability (Government of India, NITI Aayog, 2023). While science, engineering, and technology (SET) disciplines provide solutions to environmental and economic challenges, their effectiveness depends on human capital capable of innovating and implementing sustainable practices (World

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Commission on Environment and Development, 1987). HRM bridges this gap by shaping employee behavior, fostering innovation, and embedding sustainability into organizational culture (Guest, 2011). Sustainable HRM integrates ecological awareness, social responsibility, and economic viability into recruitment, training, performance management, and engagement systems (Kramar, 2014). Despite conceptual advances, empirical evidence on HRM's role in sustainability within Indian SET organizations remains limited (Jabbour & Santos, 2008). This study fills that gap by examining how HRM practices influence sustainability outcomes in alignment with *Viksit Bharat*.

Literature Review

A. Sustainable Development and the Role of Human Resources

Sustainable development is widely recognized as a multidimensional construct encompassing economic growth, environmental stewardship, and social equity (World Commission on Environment and Development, 1987; Elkington, 1997). HRM ensures that sustainability strategies translate into employee competencies and values (Ehnert, 2009). Scholars argue that technological innovation alone cannot achieve sustainability without HR systems that encourage ethical conduct and long-term thinking (Guest, 2011). In developing economies like India, HRM assumes additional significance as organizations balance rapid industrialization with ecological and social responsibilities (Sparrow, Scullion, & Tarique, 2014).

B. Evolution of Sustainable and Green HRM

Sustainable HRM extends strategic HRM by integrating ecological and social goals (Kramar, 2014). Green HRM (GHRM) focuses on environmental practices such as eco-recruitment, training, appraisal, and rewards (Renwick, Redman, & Maguire, 2013). Empirical studies show that GHRM enhances employee awareness and organizational reputation (Tang, Chen, Jiang, & Paillé, 2018; Dumont, Shen, & Deng, 2017). In engineering and technology-intensive organizations, GHRM is particularly relevant because employees directly influence energy consumption, waste management, and sustainable production processes (Ren, Tang, & Jackson, 2018).

C. HRM, Skill Development, and Technological Sustainability

Rapid technological change requires continuous upskilling. HRM facilitates this through structured training and career development initiatives (Boxall & Macky, 2009). Studies confirm that organizations investing in training achieve higher levels of sustainable innovation (Garavan, Carbery, & Rock, 2012). Skilled employees design, implement, and manage sustainable technologies, enhancing organizational adaptability and resilience (OECD, 2021). In India, initiatives like *Skill India* and *Viksit Bharat* underscore the importance of human capital in achieving sustainable growth (Government of India, NITI Aayog, 2023).

D. Employee Engagement and Sustainability Outcomes

Employee engagement mediates the HRM–sustainability link. Engaged employees demonstrate creativity and discretionary effort, essential for sustainability initiatives (Kahn, 1990; Saks, 2006). In engineering organizations, engaged employees contribute to process improvements and responsible resource utilization (Harter, Schmidt, & Hayes, 2002). Paillé, Chen, Boiral, and Jin (2018) confirm that engagement strengthens the link between GHRM and sustainability performance.

E. HRM in Science, Engineering, and Technology Organizations

SET institutions rely on specialized human capital. HRM practices directly influence research productivity and innovation (Wright & McMahan, 2011). Engineering institutions increasingly embed sustainability into their missions, emphasizing ethical engineering and environmental stewardship (UNESCO, 2020). HRM supports these



objectives by integrating sustainability criteria into recruitment, training, and performance management (Jabbour & Santos, 2008).

F. Sustainable Development and the Viksit Bharat Perspective

The *Viksit Bharat* vision emphasizes inclusive growth, technological self-reliance, and sustainability (Government of India, NITI Aayog, 2023). Human resources are central to this vision, as a skilled and ethically driven workforce is essential for leveraging science and technology for national progress. However, empirical research linking HRM, sustainability, and *Viksit Bharat* remains limited.

Methodology:

A quantitative, survey-based design was adopted. Data were collected from 210 respondents across engineering institutions, manufacturing units, and technology-driven firms. The sample included engineers, faculty, technical staff, and HR professionals. A structured questionnaire measured four constructs: green HRM, skill development, employee engagement, and sustainability performance, using a five-point Likert scale. Reliability was confirmed with Cronbach's alpha values between 0.78 and 0.88. Data were analyzed using descriptive statistics, correlations, and multiple regression.

Results:

- **Descriptive Statistics:** Sustainable HRM practices were moderately to highly adopted, with skill development scoring highest.
- **Reliability:** All constructs showed strong internal consistency ($\alpha = 0.81-0.88$).
- **Correlation:** Green HRM correlated strongly with sustainability ($r = 0.62, p < 0.01$); skill development also showed positive correlation ($r = 0.58, p < 0.01$).
- **Regression:** The model explained 52% of variance in sustainability performance. Green HRM ($\beta = 0.41, p < 0.001$) and skill development ($\beta = 0.33, p < 0.01$) were significant predictors. Engagement partially mediated the relationship.

Discussion:

Findings confirm HRM's strategic role in sustainability within SET organizations. Green HRM fosters eco-responsible behavior, skill development ensures effective use of sustainable technologies, and engagement strengthens the HRM-sustainability link. These results align with theories of sustainable HRM and support the *Viksit Bharat* vision.

Implications:

- **Managerial:** HR managers should embed sustainability metrics into HR systems, emphasizing green competencies and continuous learning.
- **Policy:** Policymakers should encourage sustainable HRM frameworks in SET institutions to advance *Viksit Bharat* goals.
- **Academic:** The study contributes empirical evidence to HRM-sustainability literature and validates a framework linking HRM practices with sustainability outcomes.



Limitations & Future Research:

The cross-sectional design limits causal inference, and self-reported data may introduce bias. Future research should adopt longitudinal designs, sector-specific analysis, and advanced modeling (e.g., SEM).

Conclusion:

Sustainable development in SET organizations requires strategic HRM interventions. This study demonstrates that green HRM, skill development, and engagement significantly enhance sustainability performance. Aligning HRM with *Viksit Bharat* can accelerate India's transition toward inclusive and resilient development.

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