

A Study on Ergonomics as a Multi-Level Public Policy Priority for Viksit Bharat @ 2047

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Abstract

India is the leading player in the international marketplace. It is the country of young people. The vision of Viksit Bharat 2047 is centered on sustainable development, efficiency of workforce, wellbeing of citizens, and inclusive economic growth. Ergonomics as an important issue of public policy deserves more attention considering the above-listed developmental goals. This research seeks to understand ergonomics as an issue of public policy and analyze its significance in achieving the developmental vision of Viksit Bharat. Ergonomics means employing scientific principles to design efficient and safe work systems that benefit human health and well-being. Taking ergonomics into account may enable human resource development and facilitate sustainable development through efficient workforce engagement and management. The following discussion will focus on various aspects of ergonomics in various fields like industry, healthcare, transport, public administration, education, and information technology. An integrated ergonomic policy approach may help transform India into a developed country within the next 30 years.

Keywords: *Viksit Bharat 2047, National Ergonomics Policy, OSH Code 2020, Artificial Intelligence, Sustainable Workplace Design, Workforce Well-being*

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1. Introduction

India's vision of Viksit Bharat 2047 seeks to transform the nation into a developed economy through enhanced productivity, innovation, human capital development, and inclusive growth. Achieving this ambition requires workplaces that prioritize employee health, safety, and efficiency. Ergonomics, which focuses on optimizing the interaction between people and their work environments, has emerged as a strategic component of sustainable development. The introduction of the Occupational Safety, Health and Working Conditions (OSH) Code, 2020 provides a stronger regulatory framework for ensuring safe and healthy workplaces across sectors. Furthermore, discussions surrounding a comprehensive national approach to ergonomics highlight the need for integrating ergonomic principles into policy, infrastructure, and organizational practices to reduce occupational risks and improve workforce performance. Such initiatives align with the broader objectives of creating a resilient, productive, and globally competitive workforce capable of supporting India's long-term development aspirations (Government of India, 2020). The rapid adoption of Artificial Intelligence (AI), automation, and digital technologies is redefining the nature of work and workplace design. While these technologies offer significant opportunities for efficiency and innovation, they also introduce new physical, cognitive, and psychosocial challenges for employees. Consequently, sustainable workplace design has gained prominence as an approach that integrates ergonomic principles, digital tools, and employee-centered practices to promote workforce well-being. Human-

centered AI systems, intelligent workstations, and adaptive work environments can enhance employee engagement, reduce fatigue, and support healthier work experiences. As organizations increasingly embrace digital transformation, embedding ergonomics within technological and organizational strategies becomes essential for balancing productivity with employee welfare and ensuring sustainable economic growth in the era of Industry 5.0 (International Labour Organization, 2024). India stands at a pivotal juncture in its developmental trajectory. The ambitious vision of Viksit Bharat @ 2047 aims for a holistic transformation that prioritises the health and productivity of its citizens. With India contributing a significant portion of the global working population, the health of its workforce emerges as a critical determinant of national development (Pingle, 2024).

2. Problem Statement

As India advances toward the vision of Viksit Bharat 2047, the need to create healthy, productive, and sustainable work environments has become increasingly important. However, ergonomic considerations often receive limited attention in policy formulation, workplace planning, technology adoption, and organizational development initiatives. The rapid integration of Artificial Intelligence, digital systems, and advanced manufacturing technologies has altered the nature of work, generating new ergonomic challenges related to physical strain, mental workload, human-machine interaction, and employee well-being. In the absence of a coordinated ergonomics-driven policy framework, organizations may face reduced productivity, increased occupational health risks, and challenges in achieving sustainable workforce development. Therefore, there is a need to examine ergonomics as a strategic public policy priority that can strengthen workforce resilience, support technological transformation, and contribute to inclusive national development (World Health Organization, 2022).

3. Objectives of Study

- To examine the significance of ergonomics in promoting workforce well-being and productivity in the context of Viksit Bharat 2047
- To analyze the role of ergonomics in supporting sustainable workplace design, occupational safety, and technological transformation
- To suggest policy measures for integrating ergonomic principles into national, organizational, and institutional development frameworks

4. Research Methodology

This study employs a Qualitative Policy Synthesis approach. This methodology is designed to move beyond mere summary, instead integrating diverse policy documents, legislative codes, and multidisciplinary research into a cohesive strategic framework. The synthesis was conducted through three distinct analytical phases:

Documentary Analysis: A critical review of the *Occupational Safety, Health and Working Conditions Code (2020)* and the *Viksit Bharat @ 2047* vision documents to identify current legislative intent and regulatory voids was done.

Comparative Jurisprudential Review: An examination of global ergonomics frameworks (EU, Singapore, UK) to identify transferable "Best Practices" for the Indian context was done.

Thematic Integration: The synthesis of emerging trends in Artificial Intelligence and Green Ergonomics into a normative three-tier policy model (Macro, Micro, and Organizational) was also done.

5. Literature Review

Macro-level policies constitute the foundational legislative frameworks that govern occupational health. In India, the evolution of these policies was significantly shaped by the 2020 enactment of the Occupational Safety, Health and Working Conditions (OSH) Code. While this code consolidated various labor laws, it primarily focuses on general safety rather than specific ergonomic mandates (Ministry of Labour & Employment, 2020). Panneer and Mathur (2016) highlighted the need for

systematic expansion of OSH measures; a major gap remains, as there is no dedicated ergonomics commission to oversee these standards.

Micro-level policies address task-level ergonomic interventions designed to optimise worker-task interactions. In the manufacturing sector, Rathore (2021) identified that management commitment and worker participation are critical enablers. However, the informal sector, which employs nearly 90% of India's workforce, presents unique challenges. While low-cost participatory ergonomics show success (Gangopadhyay, 2023), they lack scalability without national mandates. Moreover, sectors like construction and healthcare suffer from high rates of MSDs due to inadequate workstation layouts and manual handling (Das et al., 2020; Mondal & Ray, 2023).

Organizational policies translate regulatory requirements into work-place realities. Research demonstrates that organizations that adopt comprehensive ergonomics programs achieve significant improvements in productivity and worker satisfaction (Rathore, 2021). However, implementation remains inconsistent across small and medium enterprises (SMEs). The role of technology is gaining attention. AI-enabled systems are facilitating personalized ergonomic assessments; however, the concerns regarding worker privacy persist (Malik et al., 2020).

The transition of occupational health in India from a welfare-oriented focus on compliance to a productivity-focused approach centred on ergonomics is ongoing. However, significant challenges persist, including a lack of awareness and enforcement in SMEs. Capacity building is inadequate, as the number of trained ergonomists is not sufficient. Furthermore, comprehensive data systems are lacking, making it difficult to evaluate the effectiveness of interventions (Pingle, 2024). Currently, India lacks a shared 'map' of the true diversity of our people's body types. Without this, Indian workers are often forced to use tools and workstations built for Western or East Asian standards, leaving millions of them to cram themselves into spaces that weren't designed for them.

According to Panchal & Gohil (2020), ergonomics has emerged as a critical concern in the Indian Information Technology (IT) sector due to prolonged computer usage, sedentary work patterns, and increasing incidences of work-related musculoskeletal disorders (WMSDs). Studies indicate that IT professionals frequently experience neck pain, lower back pain, shoulder discomfort, eye strain, and repetitive stress injuries resulting from poorly designed workstations, inadequate posture, and extended screen exposure. Research conducted among IT employees in India reported a musculoskeletal disorder prevalence of approximately 66.8%, highlighting the significant ergonomic challenges faced by knowledge workers. Furthermore, inadequate ergonomic training, prolonged sitting, and improper workstation arrangements have been identified as major risk factors affecting employee health, productivity, and job satisfaction. The literature suggests that ergonomic interventions, including adjustable furniture, posture correction programs, regular breaks, and ergonomic awareness initiatives, can substantially reduce occupational health risks and enhance workforce well-being and organizational performance in the Indian IT industry (Chaturvedi et al. 2025).

Table 1: Global Ergonomics Frameworks and Comparative Analysis

Country/Region	Primary Strategy	Implementation Status	Key Reference
European Union	Prevention-at-Source	High; Mandatory risk assessments for manual tasks.	Council Directive 89/391/EEC

Country/Region	Primary Strategy	Implementation Status	Key Reference
United Kingdom	Evidence-based Guidance	High; Integrated into management systems via HSE.	Health & Safety Executive
Singapore	WSH Framework	Partnership-based with financial incentives for SMEs.	Workplace Safety and Health Council
Australia	Model Codes of Practice	Systematic risk management and worker consultation.	Safe Work Australia
United States	Hazard Prevention	Mixed; Focus on NIOSH elements of ergonomics.	National Institute for Occupational Safety and Health

- **Research Gaps**

The literature reveals several critical gaps:

The Regulatory Gap: There is a lack of ergonomics-specific provisions in the OSH Code 2020 (Pingle, 2024).

The Data Gap: Currently, India lacks a national database that reflects the true diversity of our people's body types. Without this, the workers will be forced to use tools and workstations designed for Western or East Asian standards, leaving millions of Indian workers to fit themselves into spaces that were never built for them.

The Technological Gap: While AI can help keep us safe, we haven't yet agreed on the rules to ensure it respects our privacy. Without clear ethical boundaries, monitoring can feel less like a help and more like invasive surveillance, potentially damaging the trust between workers and the organizations that employ them.

The Sectoral Gap: There is inadequate research and interventions in the informal sector and SMEs (Gangopadhyay, 2023). While they make up nearly 90% of our workforce, the millions of people in our informal sector, from the street vendors to small-scale artisans, are hardly covered in safety research. We haven't yet done enough to understand their unique physical struggles or to provide them with the simple, low-cost tools they need to work without pain.

6. Discussion and Analysis

- **Integration of Business, AI, and Sustainability**

Business Imperatives for Adoption: Successful implementation requires demonstrating compelling business cases. Research on Indian manufacturing units has documented that ergonomic interventions result in measurable productivity gains and reduced injury-related costs (Rathore, 2021). Framing

ergonomics as a strategic investment rather than as a cost center is essential for management commitment.

Role of AI and Technology: Artificial intelligence is transforming ergonomics practice through real-time monitoring and predictive analytics. Recent studies demonstrate that AI-powered systems using computer vision and deep learning can automatically assess postural risks with high accuracy (Lee & Lee, 2022; Su et al., 2023). Motion capture combined with machine learning enables automated physical demand analysis, providing objective assessments that complement traditional methods (AliAsgari et al., 2024). Virtual reality-based assessments integrated with deep learning offer new possibilities for proactive ergonomic risk management (Sardar & Lee, 2024).

Sustainable Environmental Practices: Green ergonomics links worker well-being with environmental goals. Smart building systems that optimize lighting and air quality reduce energy consumption while improving worker comfort (Koutroumpinas et al., 2021). Biophilic design, incorporating natural elements, has been shown to reduce stress and enhance cognitive function in the workplace.

7. Policy Recommendations for Viksit Bharat @ 2047

The following table presents 20 strategic recommendations organized across macro, micro, and organizational levels.

Table 2: Strategic Policy Recommendations for Multi-Level Ergonomics Implementation

Sr. No	Level	Policy Recommendation	Rationale & Justification	Key Reference/Citation
1	Macro	Establish National Ergonomics Commission	Centralize governance to bridge the gap between OSH safety and ergonomics	Panneer & Mathur (2016); Pingle (2024)
2	Macro	Enact "Right to Ergonomic Health"	Elevate ergonomics from advisory to a fundamental worker right under the OSH Code	Ministry of Labour & Employment (2020)
3	Macro	Develop National Anthropometric Database	Create comprehensive anthropometric data to standardize Indian-specific equipment design	<i>Proposed initiative based on literature gaps</i>
4	Macro	Introduce Ergonomic Excellence Incentive System	Financial incentives for firms exceeding ergonomics benchmarks	<i>Proposed based on global best practices</i>

Sr. No	Level	Policy Recommendation	Rationale & Justification	Key Reference/Citation
5	Macro	Mandatory Sector-Specific OSH Standards	Develop tailored codes for IT, Healthcare, and Construction (high MSD risk sectors)	Das et al. (2020); Mondal & Ray (2023)
6	Macro	Integrate Ergonomics into MSME Support Programs	Support SMEs with financial assistance for ergonomic workstation upgrades	Rathore (2021)
7	Macro	Universal OSH for Informal Sector	Extend basic ergonomic protections to the 90% of workers in the informal sector	Gangopadhyay (2023); Pingle (2024)
8	Macro	National MSD Surveillance System	Establish a real-time database for work-related musculoskeletal disorders (WMSDs)	Panneer & Mathur (2016); Pingle (2024)
9	Micro	Mandatory AI-Based Risk Assessments	Use AI-driven skeletal tracking for real-time postural audits in factories/IT	Lee & Lee (2022); AliAsgari et al. (2024)
10	Micro	Implement Hierarchy of Controls	Prioritize engineering redesign (workstation height) over behavioural training	Rathore (2021)
11	Micro	Participatory Ergonomics Mandate	Requirement for firms (20+ staff) to have worker-led Ergonomics Committees	Gangopadhyay (2023)

Sr. No	Level	Policy Recommendation	Rationale & Justification	Key Reference/Citation
12	Micro	Universal Design in Government Procurement	Government to prioritize ergonomically designed furniture and equipment	<i>Proposed policy initiative</i>
13	Micro	Standardize Remote Work Ergonomic Support	Mandate employer support for home office ergonomics in hybrid work models.	<i>Based on post-pandemic work trends</i>
14	Micro	Cognitive Load Monitoring	Regulate screen time and mental load in high-stress digital/AI roles.	<i>Proposed based on emerging risks</i>
15	Org	Integrate Ergonomics into ESG Reporting	Mandate specific MSD rate disclosures in Environmental, Social, and Governance reports.	<i>Proposed based on corporate responsibility trends</i>
16	Org	Early Intervention/Return-to-Work Programs	Formalised internal programs to manage early MSD symptoms before disability.	Singh et al. (2022)
17	Org	Biophilic & Green Design Audits	Connect net-zero goals with workplace wellness (Natural light/Air quality).	Koutroumpinas et al. (2021)
18	Org	AI-Ethics & Privacy Protections	Ensure AI postural monitoring doesn't lead to invasive worker surveillance.	Malik et al. (2020)

Sr. No	Level	Policy Recommendation	Rationale & Justification	Key Reference/Citation
19	Org	Ergonomics Certification for Organizations	Third-party audits/certifications to ensure compliance and best practices.	Ministry of Labour & Employment (2020)
20	Org	National Ergonomics Excellence Awards	Recognize organizations demonstrating leadership in workforce well-being.	<i>Proposed recognition initiative</i>

Note: Recommendations marked as "Proposed" are evidence-based policy suggestions derived from literature gaps and global best practices, rather than existing initiatives.

9. Conclusion

The field of ergonomics has now developed from merely being a discipline applicable to the workplace environment to becoming a strategic issue related to public policies with wide implications for national development. Within the framework of Viksit Bharat 2047, application of ergonomics can lead to the development of healthier workplace environments, better productivity levels, increased workplace safety and participation among employees. With respect to the continuous development process of India in terms of technology and economy, human-centered work designs become essential for promoting sustainable development. It is evident that ergonomics becomes critical for implementation at all these different levels for reaching further developmental goals related to Viksit Bharat 2047. Indeed, through application of ergonomics principles, policymakers, industries, schools, colleges and other state institutions can promote healthier and more productive workplace environments and ensure development of strong human capital and resilient organizations. It seems that an ergonomics-based policy framework could be a great starting point for India in this regard.

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