

The Associated Costs of Wearable Sensors

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Abstract:

The adoption of wearable sensor technologies in construction has predominantly been evaluated through the lens of direct financial costs, including device procurement, system integration, and maintenance. However, this narrow cost-centric framing obscures a broader set of associated and often hidden costs that arise from the non-adoption or underutilisation of such technologies. Situated within the context of green building and sustainable construction, this paper critically examines the cumulative health, safety, productivity, environmental, and governance costs linked to the absence of continuous, real-time worker monitoring systems. Drawing on a structured review and synthesis of interdisciplinary literature published predominantly over the last decade, the study adopts a conceptual and analytical research design informed by socio-technical systems theory and contemporary environmental, social, and governance (ESG) frameworks. The paper develops a conceptual framework that distinguishes between direct costs and associated costs, demonstrating how non-adoption of wearable sensors contributes to delayed health interventions, increased accident rates, productivity losses, environmental inefficiencies, and weakened organisational governance and compliance capacity. The findings reveal that these associated costs are systemic and interrelated, accumulating across project lifecycles and undermining the social and environmental objectives of green building practice. By reframing wearable sensors as preventive, human-centred sustainability instruments rather than optional technological expenditures, the paper advances a more holistic understanding of value creation in construction. The study concludes that integrating wearable sensor technologies into sustainable construction strategies can support improved occupational health and safety outcomes, enhance ESG performance, and contribute to more resilient and socially sustainable built environments, while highlighting directions for future empirical research to quantify these impacts.

Keywords:

Wearable sensors, associated costs, non-adoption costs, sustainable construction, green building, occupational health and safety, ESG performance, socio-technical systems, preventive safety technologies, construction productivity.