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A Literature Review on Drone Technology Adoption in the Indian Construction Industry

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Abstract

The construction industry is increasingly adopting digital technologies to improve productivity, safety, and project monitoring. Among these technologies, drone technology has emerged as a powerful tool for surveying, inspection, progress tracking, and documentation. Despite its technical advantages, drone adoption in the Indian construction sector remains limited. This literature review examines existing research on drone applications, technology acceptance, organizational readiness, regulatory challenges, and stakeholder perception in construction. The review highlights key adoption drivers such as perceived usefulness, ease of use, and operational efficiency, while also identifying barriers including regulatory uncertainty, lack of training, cost concerns, and trust issues. The study reveals a significant research gap in integrated adoption frameworks combining behavioral, organizational, and environmental factors within the Indian construction context.

Keywords: Drone Technology, Construction Industry, Technology Acceptance Model, Stakeholder Perception, UAV Adoption, India

1. Introduction

The construction industry plays a vital role in national economic development but is often affected by low productivity, safety risks, and inefficient monitoring practices. Recent advancements in digital technologies, including Building Information Modeling (BIM), artificial intelligence, and drone technology, have created new opportunities to overcome these challenges. Drones, also known as Unmanned Aerial Vehicles (UAVs), are increasingly used for aerial surveying, site inspection, safety monitoring, and progress documentation due to their speed, accuracy, and cost-effectiveness.

Although global studies demonstrate the technical feasibility and operational benefits of drones, their adoption in developing countries such as India remains relatively slow. Technology adoption in construction is influenced not only by technical performance but also by stakeholder perception, organizational capability, and external environmental factors. This literature review critically examines previous studies related to drone adoption in construction, with a specific focus on the Indian context.

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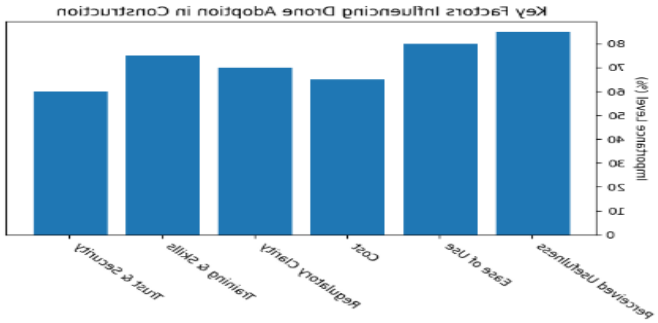

2. Literature Review

Early research on drone technology in construction primarily focused on its **technical applications and operational benefits**. Shakhatreh et al. (2018) presented a comprehensive review of UAV applications in civil infrastructure, concluding that drones significantly improve efficiency, reduce manpower, and enhance safety. Similarly, Banerjee and Sharma (2023) demonstrated that drone-based monitoring in Indian highway projects enables faster data collection and better accuracy compared to conventional inspection methods. These studies establish drones as effective construction tools but provide limited insight into adoption behavior.

To explain technology adoption, several researchers applied the **Technology Acceptance Model (TAM)**. Davis (1989) introduced TAM, emphasizing perceived usefulness and perceived ease of use as key determinants of technology acceptance. Building on this model, Rejeb et al. (2021) validated TAM in the construction sector and confirmed that both factors significantly influence stakeholders' intention to adopt drone technology. However, TAM does not account for external constraints such as regulatory policies and organizational readiness, which are critical in construction projects.

India-focused studies highlight additional adoption challenges. Paramasivam and Judson (2025) reported that drone adoption in the Indian construction industry remains low to moderate due to high perceived cost, shortage of skilled operators, and unclear regulatory guidelines. Chaudhary et al. (2023) further identified low awareness of DGCA drone regulations among construction professionals, negatively impacting adoption decisions. Studies conducted within public sector organizations also reveal resistance due to bureaucratic processes and limited digital expertise.

Trust, security, and perceived risk have been identified as important behavioral factors. Waris et al. (2022) found that trust significantly affects behavioral intention toward drone usage, while Mekdad et al. (2021) emphasized that cybersecurity and data privacy concerns reduce user confidence in UAV systems. Although these studies provide valuable insights, they are largely limited to non-construction sectors such as logistics and surveillance.

Recent research explores **advanced integration of drones with BIM, digital twins, and artificial intelligence**. Rejeb et al. (2023) and Zhang et al. (2021) demonstrated improved visualization, coordination, and progress forecasting through such integrations. Despite these technological advancements, most studies focus on performance outcomes and neglect stakeholder acceptance and readiness.

Local case studies in India, such as those conducted in Coimbatore construction projects, report improved monitoring accuracy and reduced site visits through drone usage. However, these studies are limited in scale and lack theoretical frameworks, restricting their generalizability.

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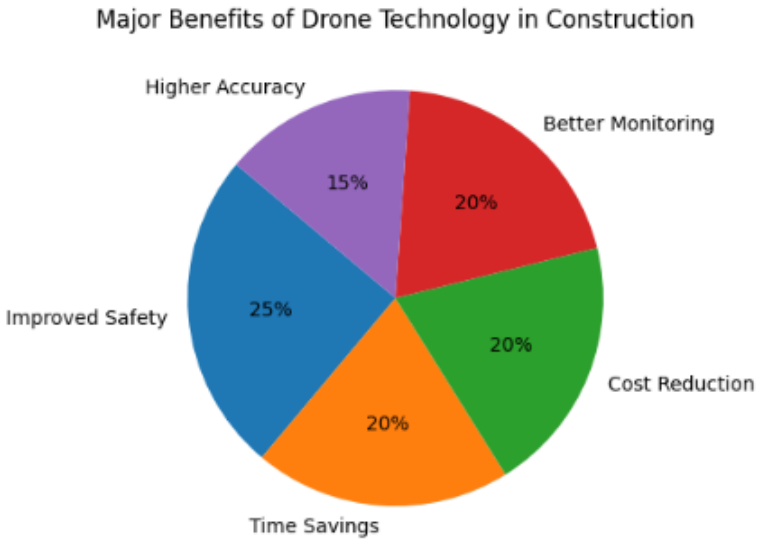

3. Research Gap

The reviewed literature indicates that most studies emphasize technological benefits and isolated behavioral factors, while limited research adopts an integrated framework considering **technological, organizational, environmental, and stakeholder perception factors simultaneously**. In particular, empirical studies focusing exclusively on construction stakeholders in the Indian context are scarce. This highlights the need for a comprehensive adoption model integrating the Technology Acceptance Model with organizational and environmental perspectives.

4. Conclusion

This literature review highlights that drone technology offers significant potential to transform construction practices by improving efficiency, safety, and project monitoring. However, adoption in the Indian construction industry is influenced by multiple factors beyond technical capability, including stakeholder perception, organizational support, regulatory clarity, trust, and training availability. The review identifies a clear gap between technological potential and practical implementation. Addressing this gap requires integrated research frameworks and targeted strategies involving policy support, capacity building, and stakeholder awareness. Future studies should focus on empirical validation of integrated adoption models to promote wider and more effective drone implementation in the Indian construction sector.

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