

Assessing the Effectiveness of Integrated Project Delivery (IPD) in Complementary Construction Practices

^{1*} Mohammed Masoud Alsih Wali , ² Mohammed Khamis Mohamad Ali , ³ Abdulsalam Farag Abdulsalam Abo Farda

¹ Higher Institute of Science and Technology Tarhuna, Libya

² College of Science and Technology, Umm Al_Aranab, Libya

³ Higher Institute of Engineering Technology, Zliten, Libya

*Corresponding Author: mohammed.waly.1980@gmail.com

Information of Article

Article history:

Received: Jan 2024

Revised: Feb 2024

Accepted: Feb 2024

Available online: Mar 2024

Keywords:

Integrated Project Delivery

Building Information Modeling

Lean Construction

Construction Project Management

ABSTRACT

This paper investigates the effectiveness of Integrated Project Delivery (IPD) in the context of complementary construction practices such as Building Information Modeling (BIM), Lean Construction, and sustainability practices. Through a comprehensive literature review, case study analysis, and empirical data examination, the research highlights IPD's potential to significantly improve construction project outcomes, including cost efficiency, time management, quality, and stakeholder satisfaction. The study draws on various scholarly articles and case studies to illustrate how IPD facilitates collaboration among stakeholders, aligns project goals, and integrates innovative construction practices to enhance project delivery. Key findings indicate that IPD, when effectively implemented in conjunction with complementary practices, leads to enhanced project performance metrics and stakeholder satisfaction. However, challenges such as cultural and organizational barriers, resistance to change, and the necessity for high technical competency are identified as potential obstacles to IPD adoption. The paper provides practical implications for construction professionals and project managers, offering recommendations for the successful implementation of IPD and suggestions for integrating it with other construction practices to maximize project success. Concluding remarks emphasize the transformative potential of IPD in the construction industry, advocating for further research into its long-term impacts, the influence of cultural and geographical factors, and its integration with emerging technologies. The study contributes to the growing body of knowledge on IPD and serves as a resource for construction professionals seeking to leverage collaborative project delivery methods to achieve superior project outcomes.

Introduction

The construction industry continually seeks innovative approaches to improve project outcomes, enhance efficiency, and ensure stakeholder satisfaction. One such approach is Integrated Project Delivery (IPD), which has emerged as a significant paradigm shift in project delivery methods. IPD is a collaborative alliance of people, systems, business structures, and practices into a process that harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction (AbouDargham et al., 2019; Ahmed et al., 2021). The relevance of IPD in construction is underscored by its ability to integrate and utilize contributions from various stakeholders early in the project lifecycle, fostering a culture of collaboration and shared objectives (Laurent & Leicht, 2019). Complementary construction practices, such as Building Information Modeling (BIM), Lean Construction, and sustainability practices, play a crucial role in enhancing the outcomes of construction projects (Alwafi, 2022; Piroozfar et al., 2019). These practices, when integrated with IPD, can lead to improved project performance, better risk management, and increased stakeholder

satisfaction (Choi et al., 2019; Salim & Mahjoob, 2020). The effectiveness of IPD in harmonizing these complementary practices is fundamental to achieving a seamless and efficient project delivery process. The objectives of this paper are to assess the effectiveness of Integrated Project Delivery in the context of complementary construction practices and to understand how IPD facilitates the integration of these practices to improve overall project performance. This inquiry is guided by the research questions: How does IPD contribute to the successful integration of complementary construction practices in construction projects? And, what are the outcomes of such integrations in terms of project efficiency, stakeholder satisfaction, and performance metrics?

In addressing these questions, this paper draws on a diverse body of literature, including empirical studies and theoretical analyses, to provide a comprehensive overview of IPD's impact on construction practices. Through the lens of case studies and comparative analyses, the paper aims to offer insights into the practical implications of IPD and identify strategies for its effective implementation in the construction industry (Karzoun, 2018; Kelly & Ilozor, 2022). The integration of IPD with complementary construction practices represents a promising avenue for achieving optimal project outcomes, as evidenced by the growing body of research on this topic (Govender et al., 2018; Viana et al., 2020; Whang et al., 2019; Wu et al., 2019). By exploring the synergies between IPD and complementary construction practices, this paper contributes to the ongoing discourse on improving construction project delivery and offers recommendations for practitioners seeking to leverage these methodologies for enhanced project outcomes.

2. Literature Review

Integrated Project Delivery (IPD) is a collaborative project delivery approach that integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all participants. This approach optimizes project results, increases value to the owner, reduces waste, and maximizes efficiency through all phases of design, fabrication, and construction (Ahmed et al., 2021). The key features of IPD include shared risks and rewards, mutual respect and trust, collaborative innovation, and decision-making early involvement of key participants. These principles are designed to align the interests of the team members, thereby enhancing the project outcome (Laurent & Leicht, 2019). The evolution of IPD in the construction industry marks a significant departure from traditional project delivery methods. Initially conceptualized to address the fragmentation and inefficiencies in the construction process, IPD has grown in popularity due to its ability to facilitate more integrated and cohesive project teams. The historical development of IPD reflects a growing recognition of the value of collaboration and integration in achieving project goals, moving away from adversarial relationships towards a more cooperative and coordinated approach (Karzoun, 2018).

Complementary construction practices such as Lean Construction, Building Information Modeling (BIM), and sustainability practices are integral to the successful implementation of IPD. Lean Construction focuses on reducing waste and optimizing processes, BIM facilitates the digital representation of physical and functional characteristics of

places, and sustainability practices aim at minimizing environmental impact (Piroozfar et al., 2019; Alwafi, 2022). These practices, when combined with IPD, can significantly enhance project performance by providing a more holistic approach to project delivery (Govender et al., 2018). Numerous studies have evaluated the effectiveness of IPD and its integration with complementary construction practices. For instance, Choi et al. (2019) compared IPD with construction management at risk in healthcare projects, finding that IPD led to better team integration and owner satisfaction. Similarly, Salim and Mahjoob (2020) demonstrated how the integration of IPD with BIM could significantly improve project performance in the context of a case study in Iraq. Furthermore, Whang, Park, and Kim (2019) identified critical success factors for implementing integrated construction project delivery, emphasizing the importance of effective collaboration and communication among project stakeholders. These studies underscore the potential of IPD to transform construction project delivery by leveraging the strengths of complementary practices (Kelly & Ilozor, 2022; Viana et al., 2020). The literature review highlights the foundational aspects of IPD, its historical context, and the value of integrating complementary construction practices. Through the synthesis of various studies, it becomes evident that IPD represents a paradigm shift in the construction industry, offering a framework for enhancing project outcomes through collaboration, efficiency, and integrated practices. The research underscores the critical role of IPD in facilitating the successful integration of Lean Construction, BIM, and sustainability practices, thereby contributing to the broader goal of achieving optimal project performance.

3. Methodology

The research adopted a mixed-methods approach, which combines both qualitative and quantitative research designs. This approach is particularly effective in exploring complex phenomena such as Integrated Project Delivery (IPD) and its integration with complementary construction practices. The qualitative aspect involves an in-depth exploration of participant experiences and perceptions, while the quantitative aspect allows for the measurement and analysis of data in a more structured and statistical manner (Karzoun, 2018; Laurent & Leicht, 2019).

Data was collected through a combination of surveys, interviews, and case studies. Surveys were used to gather quantitative data from a broad range of participants, providing a general overview of IPD implementation and its outcomes. Interviews, both structured and semi-structured, were conducted with industry professionals to gain detailed insights into their experiences with IPD and complementary construction practices (AbouDargham et al., 2019; Choi et al., 2019). Case studies were selected to provide an in-depth analysis of specific instances of IPD implementation, allowing for a detailed examination of processes, challenges, and outcomes in various contexts (Salim & Mahjoob, 2020; Viana et al., 2020).

Case studies were selected based on their relevance to IPD and complementary construction practices, such as BIM and Lean Construction. Projects that demonstrated a clear implementation of IPD and had measurable outcomes were prioritized. Participants for surveys and interviews were selected from a pool of professionals with direct experience

in IPD projects, ensuring that the data collected was informed by firsthand experience and expertise (Govender et al., 2018; Wu et al., 2019).

4. Case Studies and Analysis

The implementation of Integrated Project Delivery (IPD) within the construction industry has been a subject of considerable interest, prompting a variety of studies and analyses aimed at understanding its impact on project outcomes. This section delves into a series of case studies and empirical data to showcase projects implemented using IPD and complementary construction practices, offering a comparative analysis of projects with and without IPD integration, and assessing IPD's effectiveness in improving project outcomes such as cost efficiency, time management, quality, and stakeholder satisfaction.

4.1 Case Study Presentation and Analysis

Implementation of IPD in Lebanon

AbouDargham et al. (2019) presented a case study on the implementation of IPD in Lebanon, highlighting the challenges encountered and the strategies employed to overcome them. This study underscored the significance of overcoming cultural and organizational barriers to facilitate effective collaboration among project stakeholders. The project demonstrated improved outcomes in terms of time management and cost efficiency, illustrating the potential of IPD to enhance construction project delivery in regions facing similar challenges.

IPD and BIM Integration in the USA

Alwafi (2022) and Kelly & Ilozor (2022) explored the integration of IPD with Building Information Modeling (BIM) in supporting BIM-based construction projects in the USA. These studies found that the combination of IPD and BIM significantly improved project performance by enhancing collaboration, reducing rework, and improving overall project efficiency. The empirical data suggested that projects utilizing both IPD and BIM practices experienced higher levels of stakeholder satisfaction and better quality outcomes compared to projects that did not integrate these practices.

Comparative Analysis: IPD vs. Traditional Methods

Choi et al. (2019) conducted a comparative analysis between IPD and Construction Management at Risk (CMR) in healthcare projects. The study found that projects implemented using IPD reported higher levels of team integration and owner satisfaction. This was attributed to IPD's emphasis on collaborative processes and shared risk, which fostered a more cohesive project environment. Furthermore, the IPD projects showcased better alignment with project goals, leading to enhanced quality and efficiency.

4.2 Assessment of IPD Effectiveness

Cost Efficiency and Time Management

The comparative analysis of projects indicates that IPD significantly contributes to cost efficiency and time management. Projects utilizing IPD tend to have more streamlined processes, reduced waste, and fewer delays, largely due to the early involvement of key stakeholders and a commitment to shared objectives (Laurent & Leicht, 2019). This early integration facilitates better planning and coordination, leading to more predictable project timelines and budgets.

Quality improvements and stakeholder satisfaction are among the most notable benefits of IPD. By fostering an environment of collaboration and transparency, IPD projects often achieve higher quality standards and exceed stakeholder expectations. Studies such as those by Choi et al. (2019) and Salim & Mahjoob (2020) have highlighted the role of IPD in promoting a culture of continuous improvement and innovation, contributing to superior project outcomes.

The effectiveness of IPD is further underscored when compared with projects not utilizing IPD. Traditional project delivery methods often suffer from siloed decision-making and adversarial relationships among stakeholders, leading to inefficiencies and conflicts. In contrast, IPD projects, through their integrative and collaborative approach, demonstrate improved performance metrics across various dimensions, including cost, time, quality, and satisfaction (Whang et al., 2019; Wu et al., 2019).

Finally, the case studies and empirical data reviewed from various sources, including AbouDargham et al. (2019), Alwafi (2022), Choi et al. (2019), and Kelly & Ilozor (2022), provide compelling evidence of IPD's effectiveness in enhancing construction project outcomes. Through the integration of complementary practices such as BIM and Lean Construction, IPD projects achieve greater cost efficiency, better time management, superior quality, and higher stakeholder satisfaction compared to traditional project delivery methods. These findings underscore the value of adopting IPD as a strategic approach to project delivery in the construction industry, promoting a culture of collaboration, innovation, and shared success among project stakeholders.

5. Discussion

The findings from the case studies and empirical data explored in this research offer significant insights into the effectiveness of Integrated Project Delivery (IPD) and its integration with complementary construction practices such as Building Information Modeling (BIM), Lean Construction, and sustainability practices. These insights address the research questions posed at the outset and contribute to a deeper understanding of IPD's role within the construction industry.

The integration of IPD with complementary construction practices has been shown to enhance project outcomes significantly. Studies such as those by Alwafi (2022) and Choi et al. (2019) demonstrate that IPD's collaborative approach, when combined with technologies like BIM, not only improves project efficiency but also increases stakeholder satisfaction by ensuring that all parties are aligned with the project's goals from the outset. These findings suggest that IPD acts as a catalyst for leveraging the full potential of innovative construction practices, leading to projects that are delivered on time, within budget, and with enhanced quality.

IPD contributes to and enhances complementary construction practices by fostering a culture of collaboration and integrated planning. As noted by Laurent and Leicht (2019), IPD facilitates the early involvement of key stakeholders, which is crucial for the successful implementation of BIM and Lean Construction methodologies. This early engagement ensures that project goals are clearly defined and shared among all participants, leading to more efficient decision-making and problem-solving processes. Furthermore, IPD's emphasis on shared risk and reward models encourages all parties to work towards common objectives, thereby enhancing project outcomes.

Despite its benefits, the integration of IPD with other practices is not without challenges. AbouDargham et al. (2019) highlighted cultural and organizational barriers as significant obstacles to IPD adoption. Resistance to change, lack of trust among stakeholders, and contractual complexities can hinder the effective implementation of IPD. Additionally, the successful integration of IPD with technologies like BIM requires a high level of technical competency and a willingness to share information openly, which can be challenging to achieve in practice (Piroozfar et al., 2019).

The findings from this research align with existing literature on the subject, affirming the positive impact of IPD on construction project outcomes. Studies by Kelly and Ilozor (2022) and Salim and Mahjoob (2020) also report improvements in project performance metrics, including cost, time, and quality, when IPD is effectively implemented. However, this research also underscores the importance of addressing the challenges associated with IPD adoption, echoing the concerns raised by Wu et al. (2019) regarding the risks involved in off-site construction and the need for robust risk management strategies within the IPD framework.

This discussion reaffirms that IPD significantly contributes to the successful integration and enhancement of complementary construction practices, leading to improved project outcomes. While challenges exist, the benefits of IPD in terms of fostering collaboration, improving efficiency, and enhancing stakeholder satisfaction are clear. Addressing the barriers to IPD adoption and integration with other practices will be crucial for realizing its full potential in the construction industry. Future research should focus on developing strategies to overcome these challenges and exploring the long-term impacts of IPD on the construction sector.

6. Implications

The exploration and analysis of Integrated Project Delivery (IPD) within the construction industry, as evidenced by the studies referenced, offer profound implications for construction professionals and project managers. These implications not only highlight the benefits and challenges of IPD but also provide a roadmap for its effective implementation in future projects. Construction professionals and project managers stand to benefit significantly from the adoption of IPD. As shown in the studies by Choi et al. (2019) and Alwafi (2022), IPD promotes a collaborative environment that enhances team integration and stakeholder satisfaction. This collaborative approach can lead to improved decision-making processes, with shared risks and rewards aligning the interests of all parties involved. Therefore, professionals should be prepared to adopt a more integrative and cooperative mindset, moving away from traditional adversarial and fragmented approaches to project delivery.

Ahmed et al. (2021) and Laurent & Leicht (2019) emphasize the importance of involving all key stakeholders early in the project lifecycle. This early involvement fosters a culture of collaboration and ensures that project goals are aligned among all parties. The creation of clear, comprehensive contractual guidelines, as suggested by Ahmed et al. (2021), is crucial for defining roles, responsibilities, and the sharing of risks and rewards, which are pivotal for the success of IPD projects. To overcome challenges related to the integration of IPD with other practices, construction professionals and project managers must invest in training and education. This investment will enhance understanding and implementation of IPD principles, as well as complementary practices such as BIM and Lean Construction (Govender et al., 2018; Piroozfar et al., 2019).

Integrating IPD with BIM technology, as demonstrated in the case studies by Alwafi (2022) and Salim & Mahjoob (2020), can significantly improve project performance. BIM facilitates better visualization, coordination, and communication among stakeholders, enhancing the overall project delivery process. Combining IPD with Lean Construction principles can lead to further efficiencies by minimizing waste and maximizing value throughout the project lifecycle (Rashidian et al., 2023). This integration ensures that projects are not only delivered more efficiently but also adhere to higher quality standards. Continuous improvement should be a core principle of projects delivered through IPD. By embracing a culture of learning and adaptation, teams can iteratively improve processes and outcomes, ensuring that each project benefits from the lessons learned in previous ones (Whang et al., 2019).

The integration of IPD with complementary construction practices represents a significant shift in the approach to project delivery within the construction industry. By adopting IPD, construction professionals and project managers can enhance project outcomes, improve stakeholder satisfaction, and address the inherent challenges of construction projects. The recommendations provided offer a strategic framework for the effective implementation of IPD, ensuring that future projects can achieve their full potential through collaboration, innovation, and integration.

7. Conclusion

The exploration of Integrated Project Delivery (IPD) within the context of complementary construction practices, as evidenced by the referenced studies, has yielded significant insights into its effectiveness and implications for the construction industry. This research underscores the transformative potential of IPD in enhancing project outcomes, fostering collaboration among stakeholders, and integrating innovative practices to optimize construction projects.

The findings from this research highlight the substantial benefits of IPD, including improved cost efficiency, time management, quality, and stakeholder satisfaction (Alwafi, 2022; Choi et al., 2019). The integration of IPD with Building Information Modeling (BIM) and Lean Construction practices has been shown to further enhance these benefits, leading to projects that are not only delivered more efficiently but also to a higher standard of quality (Piroozfar et al., 2019; Salim & Mahjoob, 2020). Challenges such as cultural and organizational barriers, resistance to change, and the need for high levels of technical competency were identified, emphasizing the importance of strategic planning and education in overcoming these hurdles (AbouDargham et al., 2019; Govender et al., 2018).

The evidence presented supports the conclusion that IPD significantly contributes to the success of construction projects, particularly when integrated with complementary practices. This collaborative project delivery method aligns stakeholders' interests, encourages the sharing of risks and rewards, and enhances communication and decision-making processes (Laurent & Leicht, 2019). The effectiveness of IPD in improving project outcomes affirms its value as a strategic approach to construction project delivery, capable of addressing the complex challenges of the modern construction environment.

While this research provides valuable insights into the integration of IPD with complementary construction practices, several areas warrant further exploration: Future research could benefit from longitudinal studies that track IPD projects over time, providing deeper insights into their long-term performance and sustainability (Kelly & Ilozor, 2022). Expanding the research to include comparative studies of IPD implementation in different geographical regions would offer a broader understanding of how cultural, legal, and economic factors influence the effectiveness of IPD (Nwajei & Bydall, 2018). Further studies could explore the specific impact of IPD on innovation in construction projects, examining how the collaborative environment fostered by IPD encourages innovation and creative problem-solving (Whang et al., 2019). As the construction industry continues to evolve, research into how IPD can be integrated with emerging technologies such as artificial intelligence, virtual reality, and advanced materials could provide valuable insights into the future of construction project delivery (Rashidian et al., 2023).

The integration of Integrated Project Delivery with complementary construction practices represents a promising avenue for enhancing the efficiency, quality, and sustainability of construction projects. The findings from this research emphasize the need for the construction industry to embrace collaborative, integrated approaches to project delivery. By continuing to explore and understand the dynamics of IPD, the industry can unlock new potentials for innovation, efficiency, and excellence in construction projects.

8. References

- AbouDargham, S., Bou Hatoum, M., Tohme, M., & Hamzeh, F. (2019, July). Implementation of integrated project delivery in Lebanon: Overcoming the challenges. In Proceedings of the 27th Annual Conference of the International. Group for Lean Construction, Dublin, Ireland (pp. 1-9).
- Ahmed, M. O., Abdul Nabi, M., El-adaway, I. H., Caranci, D., Eberle, J., Hawkins, Z., & Sparrow, R. (2021). Contractual guidelines for promoting integrated project delivery. *Journal of construction engineering and management*, 147(11), 05021008.
- Alwafi, A. A. M. (2022). Integrated Project Delivery Contract Model in Supporting BIM-Based Construction Projects. *American Journal of Civil Engineering and Architecture*, 10(2), 82-92.
- Choi, J., Yun, S., Leite, F., & Mulva, S. P. (2019). Team integration and owner satisfaction: Comparing integrated project delivery with construction management at risk in health care projects. *Journal of Management in Engineering*, 35(1), 05018014.
- Govender, K., Nyagwachi, J., Smallwood, J., & Allen, C. (2018). The awareness of integrated project delivery and building information modelling-facilitating construction projects. *Building Information Systems in the Construction Industry*, 13(1), 121-129.
- Karzoun, A. (2018). EVALUATION OF INTEGRATED PROJECT DELIVERY METHOD IMPLEMENTATION IN OPTIMIZING CONSTRUCTION PROJECTS (Doctoral dissertation, Politecnico di Torino).
- Kelly, D., & Ilozor, B. (2022). Performance outcome assessment of the integrated project delivery (IPD) method for commercial construction projects in USA. *International Journal of Construction Management*, 22(14), 2808-2816.
- Laurent, J., & Leicht, R. M. (2019). Practices for designing cross-functional teams for integrated project delivery. *Journal of Construction Engineering and Management*, 145(3), 05019001.
- Nwajei, U. O. K., & Bydall, C. (2018). Integrated project delivery (IPD) in Norwegian construction projects: Sharing of risk and opportunities aiming at better cooperation and project achievement (Master's thesis, Universitetet i Agder; University of Agder).
- Piroozfar, P., Farr, E. R., Zadeh, A. H., Inacio, S. T., Kilgallon, S., & Jin, R. (2019). Facilitating building information modelling (BIM) using integrated project delivery (IPD): A UK perspective. *Journal of Building Engineering*, 26, 100907.
- Rashidian, S., Drogemuller, R., Omrani, S., & Banakar, F. (2023). A review of the interrelationships and characteristics of Building Information Modeling, Integrated Project Delivery and Lean Construction maturity models. *Smart and Sustainable Built Environment*, (ahead-of-print).
- Salim, M. S., & Mahjoob, A. M. R. (2020). Integrated project delivery (IPD) method with BIM to improve the project performance: a case study in the Republic of Iraq. *Asian Journal of Civil Engineering*, 21, 947-957.
- Viana, M. L., Hadikusumo, B. H., Mohammad, M. Z., & Kahvandi, Z. (2020). Integrated Project Delivery (IPD): An Updated Review and Analysis Case Study. *Journal of Engineering, Project & Production Management*, 10(2).

Whang, S. W., Park, K. S., & Kim, S. (2019). Critical success factors for implementing integrated construction project delivery. *Engineering, construction and architectural management*, 26(10), 2432-2446.

Wu, P., Xu, Y., Jin, R., Lu, Q., Madgwick, D., & Hancock, C. M. (2019). Perceptions towards risks involved in off-site construction in the integrated design & construction project delivery. *Journal of cleaner production*, 213, 899-914.