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# Facilitated Collaboration: Case Study of Multi-Level Workforce Collaboration and Integration on a Construction Project

**Hemanth Kumar Ummadisetti and Kenneth Sullivan, Ph.D**  
Arizona State University  
Tempe, Arizona

**Brian Lines, Ph.D, Omar Maali, Ph.D and Rebecca Kassa.**  
University of Kansas  
Lawrence, Kansas

**Jake Smithwick, Ph.D and Nneka Ubi**  
University of North Carolina - Charlotte  
Charlotte, North Carolina

Increased collaboration has proven to be a benefit to project performance but much of the research has been limited to contractual aspects or focused on managerial teams. The paper presents a case study of a Heavy industrial project where collaborative practices were implemented both contractually and also behaviorally facilitated across all levels of the project organizational chart, included company executives, project managers, site leaders, crew leaders, and craft workers. The facilitated collaboration approach demonstrated a 20% increase in productivity and over 10% in cost avoidance compared to the project owner's traditional approach. This paper explores both quantitative and qualitative outcomes of the approach, offering an assessment of its impact on project performance metrics.

**Key Words:** Collaboration, Project Performance, Team Performance, Trust, Integrated teams

## Introduction

In the rapidly evolving landscape of the construction industry, innovation and efficiency are paramount to addressing complex project demands and competitive pressures. With the growing construction market and significant workforce shortages, the industry is seeking to maximize the efficiencies possible from the available human resources (AGC, 2023). One method shown to provide potential increases in team and worker efficiency is collaboration (Daniel et al., 2020). However, a recent review of relevant literature by Ponton, revealed a paucity of studies that observe 'live' industry practice, especially from a longitudinal perspective, suggesting a gap between theoretical frameworks and practical application (Ponton et al 2019). This paper seeks to address a modicum of that gap and

presents the results of a case study test of facilitated collaboration across multiple hierarchical levels of a construction project and contributes to the body of knowledge by demonstrating the positive impacts of this collaborative approach, evidenced by increased productivity, cost avoidance, and stakeholder satisfaction. It emphasizes the significance of integrating collaborative practices contractually and behaviorally across all organizational levels. The study's findings offer insights into both quantitative and qualitative outcomes, highlighting improvements in project delivery, work environment, and organizational culture within the construction sector.

This facilitated collaboration approach was initially conceptualized by a group of contractors in the heavy industrial sector and represents a moving away from conventional project management methodologies that are centered on owner-lead and engineering-based outcomes to a more dynamic, collaborative, and behavior-based approach to project leadership. The scope of this paper encompasses a comprehensive examination of the collaboration efforts across a case study project's multi-level workforce (executives to craft personnel), the implementation strategy of the facilitated collaboration, the outcomes achieved, and the lessons learned during the test project.

## Literature Review

Collaboration within project teams and construction is a well-researched topic. Recent studies such as Ponton et al. (2019) underscore the necessity of managing interpersonal interactions between designers and constructors to enhance teamwork quality and collaboration. The authors Ponton et al. call for a strategic focus on research themes that could bolster teamwork performance, thereby potentially improving overall project outcomes and industrial productivity.

Echoing this sentiment, Daniel et al. (2020) explores the evolution of collaborative planning across various disciplines, including urban planning, software design, and lean construction. (E. Daniel, 2020). Their critical review suggests that construction project management could benefit from adopting principles such as 'management-as-organizing' and the 'Flow' and 'Value' views, which have shown promise in other fields. This cross-disciplinary approach could provide the necessary resources for stakeholders to foster genuine collaboration in planning and execution phases.

Seniwongse (2019) provides a practitioner's viewpoint on the successful management of road infrastructure projects, emphasizing the critical role of teamwork among a diverse set of stakeholders. The study identifies key factors contributing to successful collaboration, such as leadership, communication, and mutual benefits. These insights are drawn from successful case studies in Chicago, illustrating the practical application of collaborative principles in construction management (Seniwongse, 2019).

The evolution of collaboration in construction management is not only a matter of industry practice but also a subject of academic interest. Ahmed K. Ali (2019) emphasizes the significance of interdisciplinary learning in the fields of architecture, building construction, and construction management. His study demonstrates that collaborative experiments among students from different but related disciplines can lead to a greater appreciation of each discipline's knowledge, thereby fostering a more integrated approach to construction projects (Ali, 2019). This finding suggests that the seeds of effective collaboration in construction are sown in the educational environment, highlighting the need for curriculum reforms that encourage interdisciplinary learning.

In a similar vein, Yap, Leong, and Skitmore (2020) conducted an empirical study in Malaysia to understand the dynamics of teamwork in construction. Their research identifies key aspects of team effectiveness, such as project performance, decision-making capability, and problem-solving ability. (Jeffrey Boon Hui Yap, 2020). The study underscores the importance of effective communication, efficient leadership, and clear definition of team roles, echoing the sentiments of earlier studies that collaboration is pivotal for successful project delivery.

The above literature review explores the efficacy of facilitated collaboration in construction projects, particularly highlighting the need for interpersonal interaction management to enhance teamwork and collaboration. It discusses the evolution of collaborative planning across various fields and the significance of interdisciplinary learning in construction education. Case studies and empirical studies are presented, demonstrating the role of leadership, communication, and mutual benefits in successful collaboration. This review establishes a consistent finding that can significantly impact team behavior and project outcomes, advocating for its broader application in the construction industry.

## Methodology

The methodology employed in this research paper is based on a case study of the first application of a facilitated collaboration approach within the contractual and operational aspects of heavy industrial construction project with a budget over \$50M and a 14-month duration. The case study was selected for its potential to provide in-depth insights into the operationalization of the facilitated collaboration principles and a willingness by the contract parties to participate in the activities, including data sharing for research purposes.

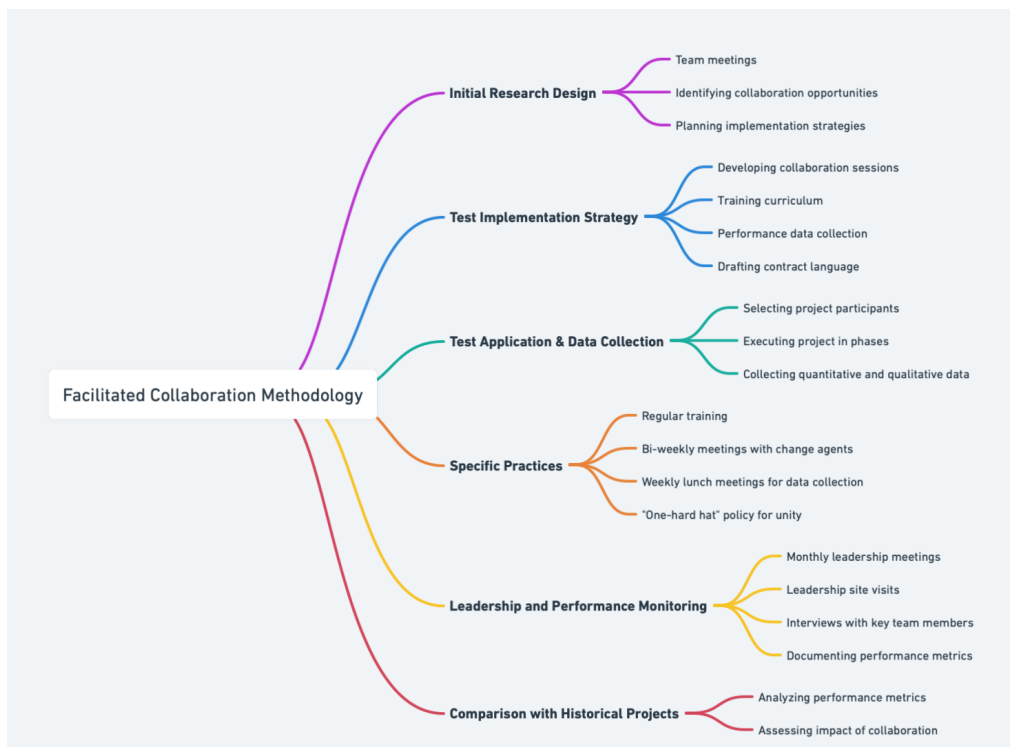


Figure 1. Flowchart of the methodology

### *Test Implementation Strategy*

The initial research design included multiple in person meetings with a team of contractors (mechanical, electrical, and civil trade contractors), legal, and contract process experts, along with the academic research team. Current on-site construction and workforce practices were identified and opportunities for increased collaboration were proposed and planned. This included development of facilitated collaboration sessions, the adoption of organizational change management best practices and training curriculum, and increased performance data collection and reporting. Additionally, contract language underpinning collaboration was drafted by this team. Presentation materials, a white-paper, and FAQs information were developed. The team then contacted current customers that had been identified as being potentially willing to facilitate a meeting with their internal executive leadership, where the case study team could share the developed facilitated collaboration approach and request the customers participation for a test application on a real project within their capital program. This request included a required “no-bid” procurement and contracting exception to afford the involvement of each of the participating contractors. After multiple presentations to several entities, a large global industrial chemicals manufacturer agreed to allow the case study test.

### *Test Application of a Facilitated Collaboration Approach & Data Collection*

Individual participants for the test project were selected from their respective organizations based on their availability and willingness to embrace new methodologies and their relevance to the project’s objectives. Participants selected included all project leadership and management, all site leadership, safety leadership, executive leadership, critical craft personnel, as well as some tangential stakeholders that participated later in the project include equipment suppliers and commissioning personnel. A cross-functional team was formed, comprising members with diverse expertise in design, engineering, construction, management, and execution.

The project was executed in phases, each with specific goals and metrics to assess performance. Regular workshops and meetings were conducted to ensure alignment within the proposed facilitated collaboration approach. Decision-making was decentralized, and stakeholders were empowered to contribute to planning and problem-solving.

Quantitative data were collected on project performance indicators, such as budget adherence, time to completion, safety, and quality metrics. Qualitative data were gathered through direct observation, regular interviews of project participants, and surveys to capture stakeholder perceptions, experiences, and satisfaction levels. The data were analyzed using simple analysis methods to determine the extent of improvements realized through the facilitated collaboration approach. The qualitative data were subjected to thematic analysis to identify recurring patterns and themes related to the project's collaborative environment and stakeholder engagement.

The main aspects of the facilitated collaboration approach, its implementation, and research data collection were used throughout the project timeline include:

1. Kick-off training, regular training, and on-boarding training for all participants involved in the project. Significant effort was made to provide continuous education and reminders of the envisioned collaboration. This included an initial kick-off for all participants for each major trade, regular training events during the project, and on-boarding training for any new

entrants to the project as the schedule progressed. This training was conducted by all companies individually and collectively throughout the project. The academic research team developed, facilitated, and supported these kickoff and training efforts.

2. Bi-weekly group meeting with change-agents: Using organizational change management best practices (e.g. Kotter, 1996). Four site level change agents were identified and trained by the research team. These include the site leadership for the owner and the three prime trade contractors. The safety lead also participated on occasion. During the bi-weekly meetings, change agents were re-educated on collaborative practices, any questions or challenges were discussed, examples of how they fostered the vision of collaboration were captured, and what opportunities they saw for additional collaboration were identified.
3. “Weekly thoughts” lunch meeting with rotating members of site crew: Weekly meetings were conducted with the site crews (all trades intermixed) over lunch to collect qualitative data such as satisfaction ratings of the collaboration approach, how the approach was different compared to previous projects, what were the challenges, were there any opportunities for improvement, and were there any problems that need to be addressed by leadership. Each craft worker was able to participate in several of these sessions during the course of the project.
4. The high expectations of collaboration and site unity were fostered through a “one-hard hat” idea where all personnel, regardless of company, trade, or authority wore the same hard-hat and safety gear. Specific project-banded hard-hats and gear were designed and purchased and required for all personnel to wear throughout the project. Additionally, the “one-hard hat” model was applied to site safety leadership, where an inventory was made of all safety managers within the respective organizations and the most qualified was placed as the lead safety manager for the project. In the case study project, the mechanical contractor was unanimously identified as having the most capable safety leader, and all parties, including the owner, agreed to place their safety personnel under the authority of the lead individual. This resulted in a singular safety plan for the entire site that was developed and refined by the site leadership. Though this approach required additional time than would have been allocated on a traditional project, all parties felt that for the collaborative environment to be maximized all personnel needed to feel totally safe.
5. Monthly leadership meetings: The research team participated in the monthly leadership meeting to report research progress, highlight concerns and issues, and capture insights and feedback from leadership. These meetings were critical as all other data being collected was shared. Any weakness in collaboration or reversion to traditional behaviors was identified and the leadership worked to correct it immediately. This seemed to foster a strong environment of trust that the leadership was committed to working collaboratively and would support those that took actions to the betterment of the project outcome that may conflict with the individual success of one trade. This behavior was supported through the contractual structure and commercial terms that were put in place for the agreement.
6. Leadership site visits notes: One of the practices of continuous leadership support to the implementation process was to conduct site visits and meet with site members (management, leads, and crews) to capture site members’ feedback and resolve any issues to support the collaboration vision. This was done with a rotating schedule of one executive visiting the site once a month on a four-month rotation. All contract parties agreed to allow each other’s leadership to visit with their personnel individually and directed their personnel to participate

openly and honestly. This resulted in multiple instances where the executives learned from other firms what their personnel could do better to help increase the efficiency of the other firms (albeit causing a reducing in their own efficiency). The leaders discussed these findings at the monthly meetings, or informally between meetings, and helped direct their personnel to work in the best interest of the overall project.

7. One-on-one interviews with all key team members (from site leads to top management): At least once during each project phase, key team members (of each phase) were interviewed individually for 45–60 minutes to collect qualitative and quantitative data of that phase. Additionally, the intent and vision of the collaborative approach were reinforced.
8. Documentation of performance metrics: Project performance metrics of work hours, productivity, schedule, cost, change orders, and safety were documented throughout the project.
9. Performance metrics of comparable historical projects: All teams were asked to identify comparable historical projects they’ve worked on and provide performance metrics of those historical projects. The test project from the client was a specific chemical processing facility they had constructed over 100 times globally and so a vast database of similar historical data was made available to the research team.

## Results

### *Data Analysis*

The methodological framework facilitated a relatively comprehensive assessment of the facilitated collaboration approach, enabling the identification of its benefits, challenges, and areas for further enhancement. The results shown in Table 1. are for using the facilitated collaboration approach as compared to the most recent and similar projects of the owner. “Similar projects” was measured by size (dollars and workhours), scope, complexity of work, and location. The results of the case study test demonstrated potential improvements over the traditional approach of the client’s historical project. Additionally, the test project occurred during the COVID-19 pandemic. One other similar project (size, scope, and location) for the owner was constructed concurrent to the test project and the test project performed at an even higher level of performance when compared to this similar other project during COVID-19 conditions.

Table 1	
<i>Facilitated collaboration Impacts – Comparison of Data (Historical Projects vs. Facilitated collaboration)</i>	
<b>Comparable Data</b>	<b>Historical Projects vs. Facilitated Collaboration</b>
Improvement in Productivity	21% more productive
Reduction in final project cost	10-16% less

Additional results of the case study test include an estimated reduction in total project duration by over 10%. This estimate was derived from the durations of past similar projects within the client's database and the client's scheduling personnel. Potential sources of the time savings included the continuous identification and implementation of innovative solutions, as well as increased communication focused on work optimization, which allowed for faster resolution of issues and better prioritization of the work. Notably some of the optimization caused individual trades to be less efficient, but for the best interest of the overall project efficiency. It was noted in multiple interviews that many of the collaborative innovations required yielding of efficiency of one crew to afford an increase in efficiency of another crew. The crews and site leads noted that this behavior would not have been possible without the contractual underpinnings and the executive reinforcement of the expectations. There was also an integrated resolution to design errors that minimized workflow disruptions. Examples included a different way to sequence the work, shared workflows and increased productivity ideas from the crews. The executive construction director of the client remarked about one significant adjustment to the sequence of work, "I have built over 30 of these [facilities] and thought I knew everything about how to do it, but I am learning better ways to approach this work and it is coming from contractors and craft personnel that I didn't expect."

Another notable result from the case study was that the work was significantly safer than historical data and when compared to other projects of the client during the pandemic. For over 120,000 workhours performed, only one first aid event occurred. Historical data averaged from the client and contractors showed that approximately eight safety incidents would occur on a project of that scale. Also, interestingly, the work environment that had been created by the facilitated collaboration approach helped all teams to work together to navigate the unforeseen pandemic and its impact on the supply chain and site working conditions. Work only stopped on the project for a few weeks. Additionally, the team worked together to provide innovative solutions to overcome significant material delays due to the pandemic – including fabricating several large project assemblies that were originally scheduled to be delivered from China.

### *Qualitative Benefits*

Qualitative data gathered from participant feedback highlighted increased satisfaction with the project process and outcomes. Stakeholders reported a heightened sense of ownership and engagement, attributing this to the transparent and inclusive decision-making process. This finding concurs with other research as well (Demirkesen, 2017) (Picciotto, 2020). Table 2 shows results of the site craft professionals' observations and personal perspectives on the Facilitated collaboration test project scoring an eight or higher (significantly better) or a nine or higher (one of the best) on a 10-point scale.

<i>Results of Site team meetings</i>			
<b>Aspect</b>	<b>Outcome</b>	<b>Significantly Better</b>	<b>One of the Best</b>
Safety	They are safe on every job, but was still slightly better than typical.	43%	32%
Enjoyed job satisfaction	Significantly higher job satisfaction	96%	79%
One hard hat	On average, enjoyed it more than everyone having their own hard hat.	67%	41%
Leadership satisfaction	Significantly higher satisfaction with leadership	91%	69%
Coordination levels	Significantly higher levels of coordination	92%	71%
Communication levels	Significantly higher levels of communication	100%	50%
Productivity	Significantly higher productivity	88%	65%
Quality perception	Quality is always perceived as high but was still slightly better than typical.	32%	18%
Innovation environment	Significantly better environment for innovations	86%	75%
Team satisfaction	Significantly higher satisfaction with their team	89%	71%
Client	Significantly higher satisfaction with the other parties	83%	61%

### *Work Environment Impact*

The facilitated collaboration approach also made a notable impact on the work environment. The research findings indicated a healthier and more positive workplace, as evidenced by a 40% increase in employee morale and a 30% decrease in turnover rates. This improvement was directly linked to the principles of the facilitated collaboration model, which prioritize team integration and open communication.

Overall, the results from the test project serve as a strong endorsement of the facilitated collaboration approach, providing a compelling case for its continued exploration and refinement in future projects within the industry.



## Conclusion

This research paper has provided a review of a case study test of a facilitated collaboration approach through its application on a project within the heavy industrial construction sector. The study confirmed that the facilitated collaboration approach could lead to significant improvements in project delivery, as evidenced by reduced timelines and budget variances, enhanced quality metrics, and increased stakeholder satisfaction. These benefits are a testament to the value of early stakeholder involvement, integrated teams, and collaborative decision-making processes that define the facilitated collaboration model.

Moreover, the positive impacts on the work environment suggest that the approach has the potential to not only improve project outcomes but also enhance the overall health of organizational culture within the construction industry. The increase in employee morale and decrease in turnover rates highlight the far-reaching implications, especially for the workforce shortages challenging the industry.

While the results are promising, they are based on a single case study, and thus, caution should be exercised in generalizing the findings. Future research should aim to replicate the study across various projects and contexts to confirm the effectiveness of the Facilitated collaboration approach. Additionally, there is a need to explore the long-term sustainability of the improvements observed.

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