Laying the Groundwork: Proactive & Reactive Interventions in Construction Multiteam Systems

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Mega construction projects are high-stakes operations that face the challenge of seamlessly coordinating the efforts of highly specialized teams to deliver high quality, complex structures under tight timelines and in physically demanding environments (Jia et al., 2023). Given the unique challenges and opportunities experienced by large scale projects such as these, they inherently operate not as one large team but instead as a multiteam system (MTSs), composed of multiple teams working towards proximal and distal goals (Mathieu, Marks, & Zaccaro, 2001). Much like traditional teams, MTSs have interdependence, specialization and coordination, and a shared purpose (Luciano, et al., 2018; Zaccaro, et al., 2020), but their structure and tasks are often more complex (Shuffler & Carter, 2018). In the construction industry, the success of such MTSs relies on precisely coordinated efforts occurring within and between numerous interdependent teams (e.g., design, engineering, owner, tradespeople, project management), to stay on schedule and within budget while meeting strict safety and quality standards (Jia, et al. 2023).

While the success of MTSs in the construction industry is critical, these MTSs are frequently disrupted by a host of challenges that may or may not be within their control, such as supply chain delays, weather delays, contracting issues, scheduling setbacks, integration of new technologies, among others (Asadi et al., 2023; Mohammadi, et al., 2018; Hasan et al., 2018). Furthermore, the structure of these MTSs can create unique and challenging situations as they often require coordination of efforts for multiple, previously unacquainted teams (Davison & Hollenbeck, 2012; Wagner, 2024). If such disruptions are not recognized and addressed effectively, they may negatively impact proximal goals (e.g., costly and time-consuming rework of tasks within and/or between teams, delayed decision-making and solution implementation between teams, conflicting team priorities due to limited resources), subsequently impeding the system's distal goals and long-term success. For example, rework has significant negative consequences for project management, including increased costs (Eze & Idiake, 2018), schedule delays (Mahamid, 2019) and exhaustion of workers (Love & Li, 2000). Rework is estimated to cost upwards of 10% of the original contract costs due to direct expenses (e.g., additional supplies, materials) and indirect costs (e.g., additional managerial and supervisor costs), which can be very costly on mega construction projects with budgets of $100 million or higher (Dougherty et al., 2012). These increases in costs, time, and labor demands place a heavy financial burden on the construction industry while also increasing the potential for safety issues, accidents and even worker harm or death (Mohammadi, et al., 2018).

Given the high stakes involved for MTSs operating in the construction industry, we have identified several critical areas in need of exploration from a research perspective. First, it is necessary to more specifically understand the types of challenges and disruptions faced in construction MTSs, and if they are unique or overlapping with those experienced by MTSs operating in similar high-stakes environments. Second, we aim to identify current and prospective approaches for addressing disruptions, both in terms of proactive interventions put in place in anticipation of potential disruptions as well as reactive interventions that are implemented only after a disruption triggers such a response. Finally, we aim to explore the temporal dynamics of such MTSs as they identify and respond to challenges and disruptions, to the extent possible within the current study design.

To address these research questions, we have implemented a mixed methods approach that integrates interviews, observations, and surveys of construction MTS frontline team members, project managers, organizational leadership, and key industry stakeholders from across the United States. Data collection was completed in two phases: an exploratory phase and a more targeted phase based on initial data collection. The exploratory phase consisted of semi-structured interviews and focus groups aimed at gaining a general understanding of the structure, functioning, and disruptions commonly faced by construction MTSs. Observations of leadership meetings were also conducted by project team members with a set of six construction MTSs for a minimum of six months per project. Two co-authors utilized an inductive approach for thematic analysis and presented the initial set of themes to a panel of 10 subject matter experts to allow for feedback.

These themes were used to guide our data collection in phase two, which involved the development of a survey sent out widely to identify key factors that support or hinder collaboration in mega construction projects. Participants were recruited through leading industry associations—including DBIA, ASHE, COAA, SAME, and PMI—as well as through established partnerships with federal agencies and private sector stakeholders. We received responses from 388 professionals, including leaders and staff representing a diverse mix of local, state, and federal government agencies, private firms, and nonprofit organizations across the United States. Respondents were asked to reflect on their most positive and most negative collaboration experiences in mega construction projects. They were also invited to participate in follow up virtual interviews to further collect detail regarding their experiences. Thematic coding of these results is ongoing, with final results to be shared during the symposium session.

Our initial findings offer a framework of core disruptions and specifically highlight the important contribution of integrating both *proactive* and *reactive* team and system-level interventions. We found that construction MTSs are continually updating in response to expected (e.g., switching out of component teams based on specialized expertise needed for the current stage of construction), as well as unexpected (e.g., bad weather, supply issues for materials), trigger events. Such trigger events are likely to require MTSs to adjust their patterns of relational states to meet new task demands. While it is expected that the existing MTS context will be a key predictor of the current or updated MTS context, trigger events can challenge the ability of the system to adaptively respond to new task demands (Luciano et al., 2015). For example, an unexpected event such as a flood on the construction site may require new configurations of expert teams and new patterns of interdependence, trust, coordination, or communication (Shuffler & Carter, 2018). Yet, the uncertainty of the new task demands could lead MTS members to turn toward those with whom they have more experience (e.g., fellow teammates) for information and advice rather than toward the members with whom they should now be coordinating (Luciano et al., 2015). Thus, to mitigate potential breakdowns in MTS collaboration, both proactive as well as reactive interventions will be required for successful performance. While proactive countermeasures should prepare existing construction MTS contexts for eventual coordination demands, reactive countermeasures should target on-going MTS dynamics to enable more adaptive responses to trigger events.

For construction MTSs, pivotal proactive interventions identified in our study thus far include: forming deliberate shared leadership structures; strategically designing project meetings as a tool for aligning or realigning goals; and building shared knowledge through technology integration. These proactive approaches were identified as being the most important for helping to prevent inefficiencies and address anticipated changes or challenges. In terms of reactive interventions, the two most prominent identified thus far include ad hoc problem solving and rapid cross-team adjustments. Such interventions were noted as being particularly important for enable the MTS to stabilize performance and maintain alignment through improved coordination and communication when unexpected challenges arise.

Overall, these findings offer several important contributions to the MTS literature as well as to our understanding of how such systems operate in the construction industry, especially in the face of challenges. First, this research addresses multiple calls to study ‘real world’ MTSs (Mathieu, 2018; Zaccaro et al, 2021), while advancing a much needed understanding of the distinctive multiteam system structural features that characterize mega construction projects (Jia, et al., 2023). Second, our study delineates the critical role of proactive and reactive interventions in sustaining coordination and performance in these complex, high-stakes construction MTSs. Finally, we identify important practical considerations and future directions for research and application regarding the development of targeted interventions that can enhance MTS effectiveness in construction settings and ultimately improve project performance, efficiency, and safety outcomes.

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