Risk versus Reward for AEC Project Team Interventions

Research Problem Statement and Purpose

Teamwork is defined as the collaborative efforts of individuals with complementary skills to accomplish a work that they cannot achieve alone, and successful outcomes depend on interactions between team members (Marks et al. 2001). Research across different domains has focused on examining if team functioning can be improved through interventions to achieve advanced outcomes (McEwan et al. 2017).

Social network interventions are systematic efforts to enhance desired behaviors, outcomes, and performance by using SNA (Valente 2012). As a robust tool to evaluate the topology of interactions in team networks (Hanneman and Riddle 2005), SNA can help identify network configurations and metrics, through which network constraints can be identified and remedied in pursuit of improving network performance (Cross et al. 2002; Frank et al. 2022). Similarly, there has been a proliferation in the number of SNA studies in the architectural, engineering, and construction (AEC) field, especially for the assessment of team communication, integration, knowledge transfers, and their impact on project network effectiveness and performance (Kereri and Harper 2018; Kereri and Harper 2019; Zheng et al. 2016).

Despite its potential for positive impacts, the intervention phenomenon remains yet understudied, and studies offering an intervention protocol for finding corrective actions for the integration, communication, and network problems to optimize project network functioning and performance are still limited in the AEC domain (Matous et al. 2021). Addressing this gap, Duva et. al (Under review) conducted a systematic review of performance and communication trends of AEC projects and developed an intervention protocol grounded in theory (Cross et al. 2006) and empirical evidence that can potentially increase expertise flows and system resilience and help improve project outcomes.

Furthermore, while network interventions can be rewarding in team settings, they carry some risks as well, especially if the emergent network structures do not match with assigned organizational structures and the network data jeopardizes actors' status (Valente 2012). Inherently, AEC project collaboration networks do not necessarily align with organizational assignments. While different contractual arrangements yield various organizational structures at the start of project delivery processes (Franz et al. 2018), new collaboration structures can arise according to project needs, individual characteristics, and team dynamics as projects continue (Chinowsky et al. 2018; Garcia et al. 2021). Hence, risks are inevitable in AEC project team network interventions.

To address this problem, this study builds on Duva et al. (Under review) and discusses risks and rewards associated with those intervention strategies for AEC project teams to improve system functioning and resilience. Specifically, this study attempts to propose the typology of

artificial intelligent (AI) interventions and discusses possible benefits and risks associated with them.

Literature Review

Robins et al. (2023) categorize the concerns related to interventions as follows: (1) network effectiveness, (2) causality, (3) intervention selection and evaluation, and (4) ethical concerns relating to who is benefiting from interventions. The *first* concern is related to implementing structural intervention recipes for effective networks without considering the internal dynamics of networks. Similarly, Duva et al. (2020) discuss that structural properties of networks might not correspond to network needs and examining network topologies and relationships between interrelated network components, such as diverse expertise exposure and boundary-spanning ties, is more beneficial to understand what is good and bad for advanced outcomes. *Second*, Robins et al. (2023) present that it is hard to make causal inferences about the effects of interventions. Observing a baseline scenario and leveraging it to guide interventions might be a solution to causality concerns and ensure a clear understanding of the benefits and outcomes of the interventions (Frank et al. 2022). Duva et al. (Under review) develop intervention strategies based on a baseline scenario by observing the communication patterns of an AEC team along with performance values over two years. *Third,* Robins et al. (2023) assert that previous studies fall short in the understanding of contagion mechanisms and social influence which has an important impact on network interventions, even though network interventions are based on the diffusion of innovations theory (Valente 2012). Duva et al. (2022) quantify the contagion mechanisms and peer influence on behavioral changes, which can be an input for network intervention development. Fourth, there is an ethical dilemma about who benefits from the interventions. Kadushin (2012) emphasizes that contrary to popular claims, individual subjects might not be the beneficiaries of interventions.

Brief Research Methodology and Approach

By using SNA augmented with mixed methods, this study builds upon the interview results and previous findings of the research team. Based on the intervention strategies developed by Duva et al. (Under review), this work focuses on automating the development of social network-based assessment of project teams by using technology to provide real-time feedback and interventions, and evaluates the rewards and risks associated with them. The following are the research questions:

> *RQ1: Can AI help with more timely intervention, or is it just helpful for the automation of the data visualizations and productivity graphs that could be used by an embedded human to develop interventions and identify when the strategies should be invoked?*
>
> *RQ2: At what capacity can AI be used to suggest interventions at any given time point? What are the possible risks with them?*

Key Findings and Implications

Valente (2012) categorizes network interventions in the order of increasing complexity as follows: (1) Individuals - supporting particular network actors as leaders of behavioral changes; (2) Segmentation - focusing on a group of people to promote change at once; (3) Induction - promoting peer-to-peer interaction to enable the dissemination of knowledge and attitudes focusing on existing nodes (e.g., individuals) and their ties (e.g., relationships); and (4) Alteration – Involving or removing nodes in the network or reestablishing ties between them to improve performance and efficiency.

The team has not completed the data analyses yet. Our preliminary findings show that there is a need for categorizing the interventions based on the complexity level and therefore, possible risks involved to ensure there is no harm to a system by overcorrecting it (Cross et al. 2002). Accordingly, AI will be used just for the most basic decisions first, and the extent of the AI interventions will be expanded. Even though AI might help with more timely interventions, the first step towards AI interventions should be having a trusted human intermediary embedded in the system until making sure that AI follows the simplest commands to reduce the risks that might occur due to the complex structure of AEC teams.

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