

ENGINEERING PROJECT NETWORK INTERVENTIONS

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EXECUTIVE SUMMARY

The vision for this research is to provide real-time feedback to project team members on communication networks to improve performance.

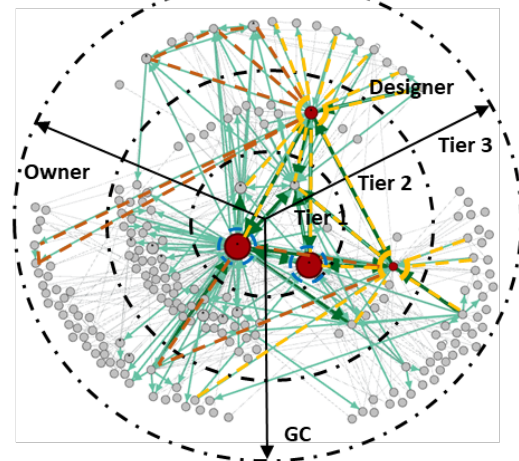
In pursuit of this vision, for the past six (6) years, our research team has:

- collected data from five Architecture, Engineering, and Construction (AEC) projects
 - ranging from \$20M to \$80.5M,
 - through multiple sources (Owners, Designers, and Contractors); and
- studied project network communications involving 75 to 7000 individuals across all organizations.

Through the extensive data we have analyzed longitudinally and verified through in-person interviews with AEC project participants, we have developed new mechanisms to better understand communication networks in complex, dynamic, and multi-layered project settings.

For example, this figure represents a communication network of an AEC project team during design development involving primary project parties (Owner, General Contractor, and Designer) where;

- Dots represent individuals, and dot size is based on the given information during team meetings.
- Links represent email communication between individuals, and the thickness of the links represent communication strength.
- Tier 1 includes project leads, with decision-making authority in the day-to-day project operations.
- Tier 2 consists of team members in Tier 1 members' home organizations.
- Tier 3 encompasses all other individuals associated with the project outside of the main organizations, such as subcontractors, vendors, and consultants.



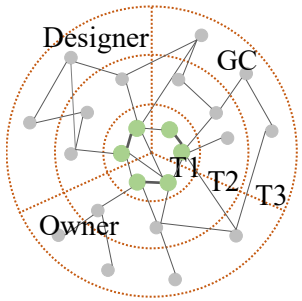
Accordingly, we have developed **practical implications for team formation and management for successful delivery of mid-sized AEC projects.**¹

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PRACTICAL IMPLICATIONS

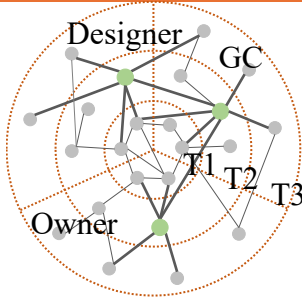
1. **Teams of two - Project leads** working in **teams of two** for technical and communication coordination is a good practice that can help all primary parties balance workload, avoid communication overload, and improve team resilience for unexpected events (e.g., COVID-19, turnover).

- Both individuals should be highly experienced in project specific technical domains while their relative authority must be negotiated in response to projects' immediate demands.
- Consider assigning a communication lead with relevant experience for the user group within the **Owner** organization. Having a "go-to" person overseeing the user-group coordination is beneficial for project team communications and programming.

Network Element	Importance	Possible Threats	Strategy for AEC Teams	Network Visualization
Teams of Two as Central Connectors	Critical with the most direct connections; thus, should be addressed to improve engagement	Likely to experience communication overload if not appropriately supported in the networks	<ul style="list-style-type: none"> • "Communication and technical leads" in tier 1 as teams of two per role • Qualification-based selection-prior experience • Continuing engagement of the leads • Balanced leads for network resiliency. 	

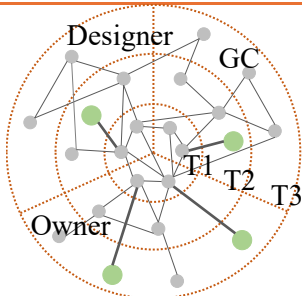
2. **Communication Support - A 'communication support'** can be highly beneficial in assisting the project's communication leads.

- Consider assigning support personnel to communication leads under **Designer** and **General Contractor** roles to benefit the whole project team.

Network Element	Importance	Possible Threats	Strategy for AEC Teams	Network Visualization
Communication Support as Brokers	Informal informational leaders who are on the shortest path between others and are ideal to diffuse information	Likely to experience structural holes and delays in getting necessary information if missing a broker	<ul style="list-style-type: none"> • "Communication support" in tier 2 connecting tiers, roles, and experts • Empowering a broker in designer starting with design phase and in GC starting with construction 	

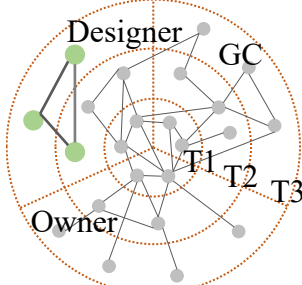
3. Peripheral Players - Highest team productivity occurs when team members from all expertise areas and organizations exchange information.

- Consider project’s priority issues and stay adaptive in communications to ensure that relevant experts are engaged regardless of their role, organization, and assignments.

Network Element	Importance	Possible Threats	Strategy for AEC Teams	Network Visualization
Peripheral Players	Individuals with under-used and novel skills, expertise, and knowledge	Likely to experience redundancy if peripheral members are not involved	<ul style="list-style-type: none"> • Expertise integration from the “peripheral members” within or outside of the organization • Inviting them to face-to-face meetings for planned times based on the needs 	

4. Targeted Involvement of experts (regardless of their position in the network) can help speed up issue resolution and improve team members’ sensitivity towards project priorities.

- Consider bringing key expertise from outside parties such as subcontractors, consultants, and vendors in a timely manner to project communication network.
- Instead of relying solely on email communication, consider inviting leads of outside party representatives to face-to-face meetings for targeted discussions.
- Consider inviting secondary team members to limited and planned sessions during in-person project meetings to protect them from communication overload and improve their sensitivity towards project priorities.

Network Element	Importance	Possible Threats	Strategy for AEC Teams	Network Visualization
Targeted Involvement for Fragmentation Points	Fragmentation points are gaps in the networks due to expertise differences, hierarchy, or location	Likely to have disruptions in knowledge transfers if not addressed	<ul style="list-style-type: none"> • Targeted involvement of experts by activating the brokers (i.e., communication support) in tier 2 to promote necessary expertise 	

5. Boundary Spanning - AEC project team members often are dispersed geographically and organizationally. Boundary spanners that cross organizational, hierarchical, geographical, and cultural boundaries can facilitate effective knowledge transfers with external stakeholders and help improve project performance.

- Team members should remain adaptive in their communication exchanges with others regardless of their tiers and role. To ensure external connectivity, project leads should encourage an environment of collaboration and trust to promote boundary-spanning knowledge transfers.

Network Element	Importance	Possible Threats	Strategy for AEC Teams	Network Visualization
Boundary Spanning for External Connectivity	Connecting external stakeholders, who are technically, geographically, or culturally dispersed	Likely to experience information redundancy, lack of expertise diversity, and innovative solutions	<ul style="list-style-type: none"> • Active engagement of the team members from different roles/tiers and expertise and enabling boundary spanning 	

6. Additional Considerations

Prior working experience reinforces trust between team members and can help improve project team efficiency.

- Consider bringing people with previous experience on board, especially in key roles such as technical and communication leads and supports.

Personnel changes are common in project teams. Prior to **personnel transitions** during project delivery, especially for the high influence roles:

- Consider having an overlap period between the people that transition in and out of the project team to transfer the necessary know-how and smoothen the process. If there is more than one successor, the roles, responsibilities, and boundaries of these people personnel should be made clear.

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ACADEMIC PUBLICATIONS FOR THIS WORK

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