Critical competencies for trade partners involved early in the design phase of construction projects

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Abstract

In executing the construction or installation of different building systems, trade partners acquire knowledge and skills that can improve the systems' design to support installation. A combination of these trade partners' knowledge areas, skills, and attributes (KSAs) influences their competency in supporting the product and production design process. Despite the growing efforts to integrate construction specialists early in the design process, research on KSAs that enable trade partners to influence design outcomes is limited. Furthermore, the KSAs that significantly impact the successful performance of the roles and responsibilities of trade partners during design are yet to be identified. There are limited models focusing on elaborating trade partners' KSAs applicable in the design phase of the project. This study aims to identify the critical KSAs required for trade partners to support the building design development process. It also identifies the interdependence between these competencies and the responsibilities performed during the design phase. This study adopted a mixed-method design to identify, verify, and validate these competencies. Two focus group sessions with industry practitioners experienced in the early involvement of trade partners in construction projects were conducted to refine the list of KSAs generated from the literature. The process also helped to further identify additional KSAs specific to trade partners' participation in the design process. The findings present potential value for developing competency assessment criteria to support owners, designers, and construction managers seeking to engage trade partners in collaborative design processes. The findings can also be informative about developing training or professional development resources for trade partners.

Introduction

The traditional delivery method, Design-bid-build (DBB), is not structured to allow any form of early interaction of the project team for exchange of knowledge that supports design and construction processes improvement. To address the negative impacts associated with the DBB, the construction industry is gradually moving toward more collaborative approaches to project delivery. In this collaborative practice, the input of design, construction, and trade partners is integrated early to achieve better project outcomes. The industry is beyond a tipping point towards working with non-DBB project delivery systems. Delivery methods that allow for the engagement of the construction management and trade partner teams early in the design processes are therefore starting to gain traction.

Close to 80% of projects within the US are starting to or are in the process of adopting some form of collaborative delivery methods (Sullivan et al., 2017). These include design-build (DBB), construction management at risk (CMAR), and integrated project delivery (IPD), which support the early engagement,

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although at varying extents (Franz et al., 2020). However, the approach to engaging construction specialists early in the delivery process, in particular trade partners, still relies on practices associated with traditional forms of contracting. The evaluation of suitability of trade partners to contribute to better outcomes in the early stages of design is still based on pricing and technical company-level capability. However, this approach may be challenging during the early stages where design information is limited. Therefore, there is value in defining criteria for evaluating suitability of trade partners in influencing design process outcomes. The limited research on competencies that can be considered makes evaluation of trade partners for positive contribution in the design process challenging.

Current research emphasizes first tier, or general contractors' competencies required in the design stage processes. The competencies required of CM/GCs for early design involvement are clear in literature. These range from technical knowledge and skills, such as design requirements in relation to cost, schedule, and risks. This knowledge and skills are required alongside professional and personal competencies (Ghorbani, 2023). The Project Management Institute also outlines the key knowledge areas construction managers require to successfully engage in collaborative projects (Project Management Institute, 2017). General contractors often subcontract close to 90% of the scope to trade partners. However, the competencies of trade partners to engage and actively contribute to better project outcomes from early in the design is overlooked. The technical and behavioral knowledge, skills, and attributes specific for trade partners involved early in the design process is yet to be clearly communicated. Researchers have started to recognize the need for studies on early engagement of trade partners in the design processes (de Graaf et al., 2023) but the efforts are still limited. To address this gap, this study aims to identify the key competencies that need to be considered when evaluating trade partners to engage in the design process.

Literature review

Performance responsibilities of trade partners in the design process

Building owners have consistently pushed for better project performance, leading industry practitioners to adopt project delivery methods that result in desirable outcomes. Integration of design and delivery processes through early team collaboration and the use of contracting models allowing for earlier engagement and communication among project participants are now preferred (Choi et al., 2019). It has been demonstrated that early interaction enables better definition of construction requirements early in the project, allowing for certainty of construction process outcomes.

This early scope definition also allows trade partners to familiarize themselves with the design intent. It also supports their contribution to design development, minimizing downstream change orders and requests for supplemental information (Koolwijk et al., 2018). Over the decades, the project design process has morphed from siloed development of design with the owner to acknowledgement of the valuable construction input in developing the design intent. Redefining the required knowledge areas that trade partners interacting with the designers need to better support the design development is inevitable (Christensen et al., 2023).

The early assessment of construction process requirements during design calls for identifying scopes of the design that trade partners can provide the highest influence to achieve efficiencies and cost savings. Once the scopes are identified, the trade partners with competencies in these scopes can be brought on board to support the development of details. The knowledge trade partners acquire from installation, fabrication, and

construction means and methods can be translated to provide perspectives on methods of optimizing systems layout, achieving efficient sequencing, coordination system interphases, and achieving costs, schedules, systems performance requirements. Trades also have insights on supply chain constraints that may impact different design decisions. In other instances, trade partners assume the role of developing the design, often when there are high system complexities. The level of design complexity influences the related responsibilities. In complex designs, the owner-contractor-designer team may allocate the trade partners greater responsibilities and require engagement with more complex tasks (de Graaf et al., 2023). For these trade partners to successfully perform these responsibilities, there is a need to better understand what competencies can be used to gauge their preparedness to provide required support.

Theoretical models evaluating performance competencies of team personnel

Construction projects, although temporary, embody an organizational structure where multiple participants from different areas of specialization work together toward defined sets of goals. Engaging participants with the right competencies through value-based selection is likely to improve the potential for project success (Franz & Leicht, 2016). This view of projects as temporary organizations provides a justification for applying organizational models in the assessment of suitable project participants.

In construction projects, the owner signs direct contracts with companies. However, the personnel assigned to the project by the individual companies significantly influence the project's success. These personnel's competencies are often considered part of the evaluation when selecting the companies to be part of the project team (El-Kholy, 2022). However, the early collaboration renders traditional models for construction firm selection less relevant. There is also a lack of models for assessing competencies predicting successful engagement of individual participants from trade partner organizations. It therefore becomes critical to evaluate existing competency-based models to draw insights on personnel selection in addition to trade contracting company selection for participation in the design process.

Competency in executing assigned responsibilities can be evaluated based on knowledge of task components, task experience, and individual personality that drives successful execution. Borman and Motowidlo (1997) developed the task-contextual performance model to assess personnel competencies. Within this model, task performance competencies are determined by the knowledge of the technical characteristics of the job and vary across different areas of specialization. Contextual performance, however, focuses on the attributes that help the participant align with the organizational, social, and psychological environment when performing duties. Contextual performance can be related to personal attributes that impact the successful execution of technical and non-technical responsibilities (Motowidlo et al., 1997).

Participants' previous experience influences their collective performance of technical tasks. Their effectiveness in completing the tasks related to the project is influenced by the abilities of other participants and conversance with the tasks from previous exposure. The participants' personalities, however, impact how they cultivate an environment conducive to performing tasks (Mohammed et al., 2002). This means that the selection of participants for the successful execution of team-based activities must consider their individual abilities, technical and non-technical skills, and personal attitude towards.

Models specific to construction have further categorized knowledge, abilities, and attitudes into four main categories: technical, academic, workplace, and personal. According to this model developed for transportation construction personnel, categorization helps easily assess the areas of deficiency and plan additional training and professional development initiatives. Academic competencies are obtained

throughout the learning journey and are not unique to a specific job category but may be unique to a certain field, for instance, computer literacy, oral communication, and mathematical computation skills. Technical competencies are, however, specific to the job under assessment (Harper et al., 2023). For construction personnel, knowledge of and ability to perform specific tasks such as scheduling, materials assessment, means and methods evaluation, inspection of work are considered technical.

Further, analysis and comprehension of drawings or specifications, understanding of regulations and codes, and use of construction tools and technologies complement the execution of the technical competencies. Workplace attributes, which align with contextual performance, cover the personal attitudes that facilitate effective performance of tasks related to the job. These include critical thinking, team building, attentiveness, ability to adhere to directions, decision-making, teamwork, and organizational skills. Personal attributes such as the level of initiative, flexibility, adaptability, integrity, and curiosity create a more conducive environment to apply technical knowledge and skills (Harper et al., 2023).

Technical and behavioral competencies gap for trade partners in the design phase

Trades partners are engaged in the process to complement the successful execution of early project's design phase tasks based on their construction process expertise. Competency in performing assigned roles and responsibilities related to this design process tasks need to be evaluated based on the technical abilities and behavioral attributes that impact task performance. Three areas are evaluated as part of the competency model: the knowledge of the technical tasks associated with the job, the skills and abilities in performing these tasks, often derived from training and experience, and the individual attributes of the personnel that can be assessed (Harper et al., 2023). These competencies are referred to as KSAs (Knowledge, skills, and attitudes). In team contexts where the overall success of the project is dependent on the competencies of all participants, it is important to consider the individual KSAs which predicts successful collaboration and project outcomes (Mohammed et al., 2002). Three aspects determine their competence to execute assigned roles and responsibilities within the design phase (Project Management Institute, 2017).

Responsibilities performed by construction specialists in the early design phase differ from those performed during the construction phase. The value of having trade partners early in design is linked to both their understanding of complexities in systems and product assembly and capacity to translate this knowledge to support design process (de Graaf et al., 2023). The extent to which the participants engaged can provide this input depends on the KSAs required for collaborative design participation.

It is therefore evident that there exist gaps in the evaluation and recommendation of desired KSAs for second-tier construction specialists. First, the competencies of trade partners in the early project phases, including planning and design, have not been comprehensively defined and structured. There are also limited models to support the assessment of trade partners' suitability for engagement in the design process. This study aims to identify the competencies trade partners require to effectively contribute to the design phase process and complete their responsibilities during the design phase of the project. A set of KSAs critical to design-phase job performance are specified for trade partners involved early in the design processes. Figure 1 summarizes the task-contextual performance-based conceptual model adopted in the study. The model combines the knowledge areas, skills and abilities, and attitudes that trade partners require to effectively support design development and construction process planning in the design phase of the project. Task performance in the model relates to technical knowledge and skills associated with design assist trades involvement while contextual performance relates to the non-technical attributes.

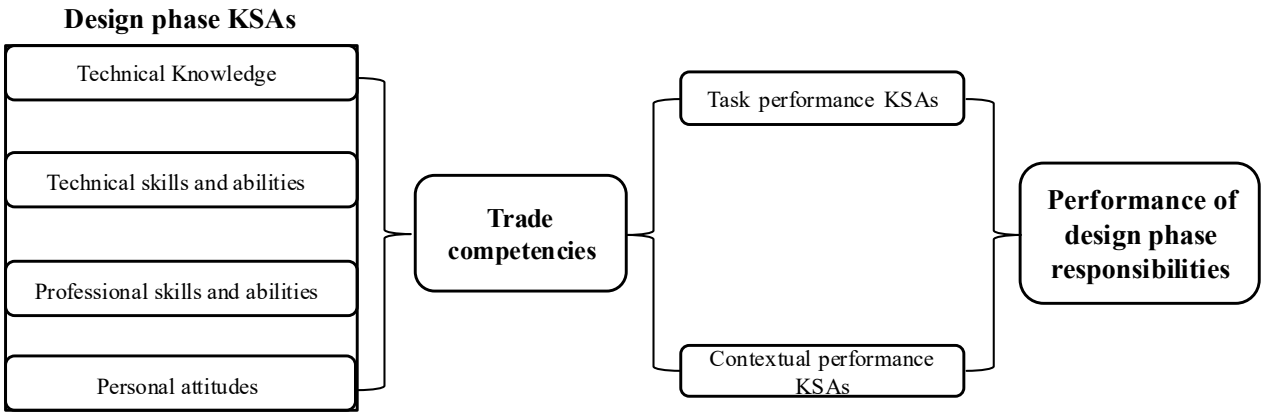

Figure 1: Trade partners design-phase KSAs and tasks performance conceptual model

Research Process

Although the construction industry has embraced the integration of design and construction processes, clarity on additional performance requirements resulting from the early integration has not been achieved. This study explores the competencies trade partners require for effective engagement early in the project's design phase. Through a two-step process, this study explores the relevant competencies that support the early involvement of trade partners in the design process.

The first step consisted of a critical review of existing literature on the competencies of technical personnel with a specific focus on the design and construction specialists. The literature search was confined to Google Scholar, Compendex, the American Society of Civil Engineers (ASCE), and the Web of Science databases. Key search terms included "trade partners," "subcontractors," "contractors," and "knowledge, skills, and abilities," or "design and construction competencies." Both theoretical and empirical studies were identified from these scientific databases. The review was limited to peer-reviewed journal papers and conference proceedings from these databases, with wider coverage selected due to the limited literature on the competencies of construction personnel, specifically trade partners. Based on these elimination criteria, only studies relevant to the design and construction contexts were used to guide the identification of the trade partners' KSAs. The critical literature analysis was limited to publications related to technical engineering management competencies, including building and infrastructure design and construction specialists. The findings from the literature synthesis provided a basis for outlining the key knowledge, skills, and attributes of trade partners. In the second step, the design and construction competencies identified from the literature were integrated by intersecting competencies essential for both design and construction specialists.

The identified common competencies were further evaluated and validated through two focus group discussions with ten industry practitioners with extensive early trade partners' experience. These practitioners were selected due to their industry expertise with early trade partners' involvement in the Lean Construction community. All participants have more than fifteen years of industry experience and have been involved in multiple projects across delivery methods that have involved trade partners in the early design phase of the project. The participants were also selected from different areas of specialization: owners' representatives, trade partners, and Lean experts. A follow-up five-participant focus group was conducted to further evaluate the classification and relevance of the KSAs. The two focus groups facilitated

the refinement of the KSAs based on their interaction with the early trade partner involvement process in real-world contexts.

Results and discussion

Competence requirements for construction specialists

Overlapping design and construction facilitates early interaction between design and construction specialists. Delivery methods allowing for this contracting model have rapidly gained popularity, accounting for more than 60% of total projects within the US construction industry. While this early interaction enables better planning of the design and construction processes, it comes with significant coordination and relational challenges due to the multiple organizations and specialties involved (Khouja et al., 2021). To obtain optimum output from the early collaboration processes, the selection of design and construction disciplines based on competencies can supplement other factors that lead to successful performance in collaborative forms of project delivery contexts. For construction specialists, distinct criteria exist for assessing their competence to perform production processes. However, this criterion is lacking when construction specialists are involved in the design process.

When selecting trade partners from a pool of different competitors, criteria such as qualifications of personnel, recognition of the companies, years of experience, and performance from past projects are considered valuable. Demirkesen and Bayhan (2019) proposed different criterion to evaluate these competencies by ranking them based on the extent to which each criterion can generate project success. With this advantage-based ranking, aspects such as cost, prioritized in traditional delivery, have a minimal advantage in evaluating competency to execute the work. Qualifications and knowledge derived from previous experiences play an important role in determining the level of competency to execute the scope defined in the contract (Demirkesen & Bayhan, 2019).

The heavy involvement of the construction manager or general contractor in the early design phase skews the literature toward project management-specific competencies. The competencies specific to construction managers can be broadly categorized into technical and behavioral competencies, as summarized in Table 1. Technical competencies relate to the knowledge of task technicalities for the specific scope of work (Ghorbani, 2023), often obtained from rigorous training or education (Project Management Institute, 2017). Engaging in the performance of scope-specific responsibilities within the project allows the personnel to acquire skills in applying the knowledge gained through education, training, and project experience. Skills are, therefore, obtained through experience-based exposure to task performance. Behavioral competencies relate to the interpersonal attributes displayed when performing technical tasks using the acquired skillsets. These behaviors have been linked to participants' personalities and professional dispositions (Ghorbani, 2023).

Technical knowledge in project management aspects, such as packaging in line with the scope of work, building systems or materials performance characteristics, codes and standards related to the project type, and regulatory requirements are crucial for construction project managers during the early design phases (Ahadzie et al., 2014). Additional knowledge of means and methods, cost estimating, risk identification, schedule development, and proposal development are vital for successful process management. Understanding the contractual requirements, measurement of performance outcomes, systems and materials specifications, and quality assurance and control processes (Harper et al., 2023). The skills associated with

the performance of these technical knowledge areas have been defined from both the technical and behavioral angles. Performance skills related to technical knowledge capture aspects such as schedule development using advanced tools, guiding the planning of project milestones, budget development, risks or opportunities analysis, interpreting design details and reports, and evaluating decisions.

Table 1: Competencies for construction managers involved early in the preconstruction process

Technical competencies		**Behavioral competencies**	
Technical knowledge	***Technical skills***	***Non-technical skills***	***Personal attitudes***
Construction products performance	Product performance analysis	Communication	Flexibility
Means and methods	Means and methods specification	Team collaboration	Respectful
Scheduling procedures	Schedules and milestones planning	Innovativeness	Trustworthy
Construction contracts requirements	Contracts interpretation	Leadership	Decisive
Cost estimation procedures	Cost forecasting and budgeting	Time management	Empathetic
Codes and regulations	Code and regulatory conformance evaluation	Listening	Assertive
Product and systems specifications	Product specifications assessment	Initiative	Focused
Quality assurance and control procedures	QA/QC assessment	Analytical	Patient
Work packaging	Work package development	Conflict resolution	Creative
Building performance assessment	Performance details interpretation	Work prioritization	Self-motivated
Labor and supply chain trends	Labor and long lead items analysis	Problem solving	

During the execution of technical tasks, the construction specialists develop non-technical skills that support the effective performance of the technical tasks (Franz et al., 2023). Non-technical skills such as effective communication, listening, leadership, time management, innovativeness, analytical, and initiative skills further enable collaboration with other project team participants. These non-technical skills vary across individuals and, therefore, cannot be generalized for specific specialties. Attitudes, the other component of personnel competencies, define the personal attributes of the personnel. Characteristics include trustworthiness, assertiveness, decisiveness, focus, endurance, patience, flexibility, and empathy (Franz et al., 2023; Moradi et al., 2020). These construction competencies inferred from literature on general contractors can provide a basis for evaluating the construction competencies applicable to trade partners.

Potential competency requirements for specialists involved in the design phase of the project

There exists some agreement on the competencies-built environment personnel involved in the design phase of the project should possess. Although these competencies are specific to design specialists, they may be

used to inform the identification of competencies suitable for other personnel interacting with the design, such as construction managers and trade partners. Studies have explored these knowledge areas within the building design domain (American Institute of Architects, 2013). Understanding these competencies can clarify the categories of competencies that trade partners can leverage to perform their responsibilities during the project's design phase. In defining and specifying sound design options, designers are expected to leverage their knowledge of features of building components and systems, performance of building materials and systems, means and methods of constructing or installing defined components, and hazards associated with their use or installation (Daryono et al., 2024). These are reinforced with knowledge on assessing site characteristics and construction layout such as phasing, sequencing, and logistics based on site features (Che Ibrahim et al., 2020).

Understanding the fundamentals of building cost estimation, cost and benefit assessment for specified components, sequencing, and scheduling requirements become essential in facilitating decision-making related to the design (Daryono et al., 2024). However, designers have limited specialization in these areas; therefore, a core part of the need for construction specialists during the design process (Ferme et al., 2018). Upon specifying different building systems and components, designers need to know different modeling and visualization techniques to better communicate the proposals with parties external to their discipline. All designs must conform to minimum standards and building codes. Designing and specifying buildings that align with codes and regulatory standards requires knowledge of local, national, and international codes and standards that impact the building and its environment (Shin et al., 2023). Table 2 summarizes the key knowledge areas, skills, and personal attitudes of design practitioners. Designing and specifying buildings that align with codes and regulatory standards requires knowledge of local, national, and international codes and standards that impact the building and its environment (Shin et al., 2023). Table 2 summarizes the key knowledge areas, skills, and personal attitudes of design practitioners.

Designers also require skills in the use of information technology that support the modeling and visualization process to communicate better and capture stakeholders' requirements within the defined design space features (Wesołowski, 2022). Non-technical competencies such as analytical skills, innovativeness, critical thinking, leadership, teamwork, reliability, and cognitive flexibility have been identified as essential for designers (Wesołowski, 2022). Personal attitudes and dispositions influence the extent to which both technical or non-technical knowledge and skills are effectively applied during the design process. Designers with high motivation, work ethics, vision, and confidence are likely to successfully execute their responsibilities (Shin et al., 2023). Additional personal attributes such as trust, commitment, and teamwork are critical to designers' success (Che Ibrahim et al., 2020).

Table 2: Competencies of personnel involved in the design phase of a project as inferred from literature

Technical competencies		**Behavioral competencies**	
Technical knowledge	***Technical skills***	***Non-technical skills***	***Personal attitudes***
Building components features	Information technology	Critical thinking	Flexibility
Building systems (MEP/FP)	3D modeling and visualization	Innovative	Visionary
Design tasks and deliverables	Building performance analysis	Leadership	Self-motivated
Building materials and systems performance specification	Environmental Impact Assessment	Teamwork	Confident
Drawing, modeling, and visualization	Building components and systems analysis	Analytical skills	Ethical
Design space and objects integration	Cost assessment	Communication skills	Trustworthy
Construction means and methods	Design layout and sequencing		Committed
Construction phasing and sequencing requirements			Reliable
Building hazards identification			
Building cost estimating fundamentals			
Building codes, standards, and local regulations			

KSAs essential for trade partners' performance of design phase responsibilities

Intersecting the design and construction KSAs provides a baseline for the assessment of the competencies of specialists involved in both the design and construction processes. It also provides a pathway for evaluating the competencies of construction trades involved in the design processes. Therefore, the combination of both the competencies identified in the literature generated a comprehensive evaluation model for trade partners for early design involvement, summarized in Figure 2.

Trade partners require deeper knowledge of building components and system characteristics to support design phase processes effectively. This knowledge, in turn, translates to constructive assessment of the performance of alternative options considered during the design process. Understanding the building codes and standards is also essential for better assessing systems and layouts suitable for the specific project type. Knowledge of building sequencing and phasing is also essential to provide designers with input based on the proposed building layouts. Trade partners also need to have knowledge of fundamental cost estimation and scheduling procedures to provide cost and construction feedback on alternatives to designers.

In performing tasks related to these knowledge areas, trade partners develop technical skills such as cost estimating, pull planning and scheduling, systems analysis, means and methods specification, and codes and standards compliance assessment depending on the project type and needs.

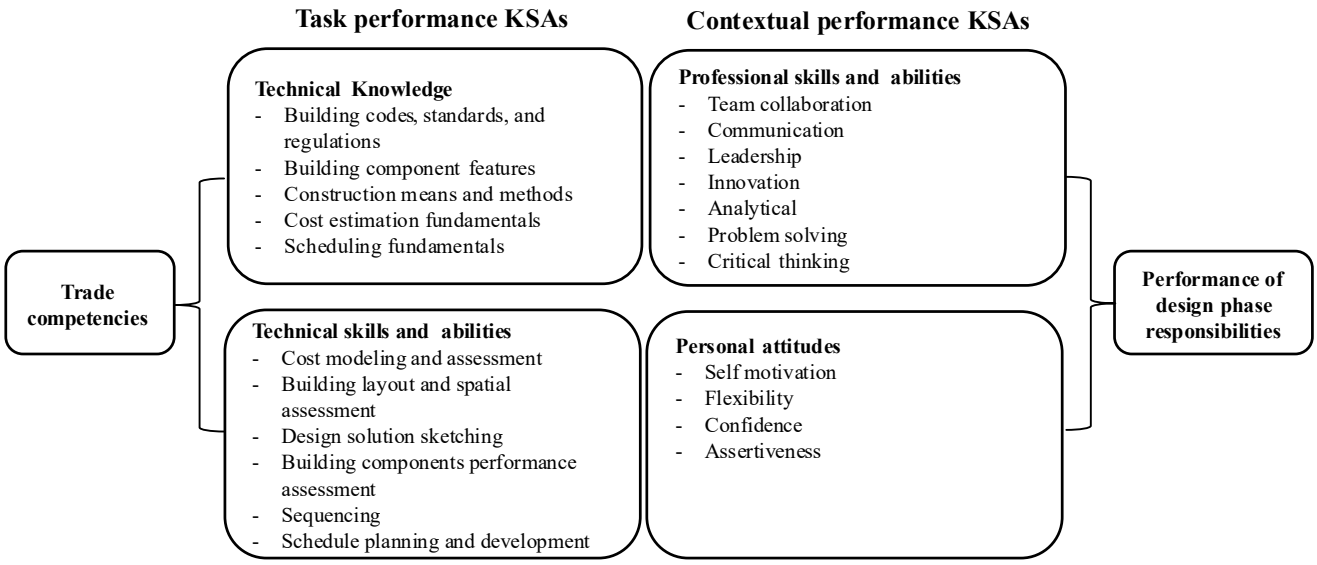

Figure 2: Trade partners design responsibilities performance KSAs

Performing the technical processes associated with trade partners' responsibilities in the design phase also requires non-technical skills such as team collaboration, leadership, analytical, innovation, critical thinking, and strong communication skills. Individual attitudes such as trustworthiness, self-motivation, flexibility, confidence, and assertiveness are also essential for task performance in both design and construction processes.

Additionally, industry practitioners proposed competencies they have found useful in achieving positive outcomes during the early trade partners involvement process. These are summarized in Figure 3. The practitioners stressed the need for trade partners to have knowledge of environmental rules and regulations that may impact on the solutions viable for different types of projects. As the industry progresses toward innovative design and construction, modular and prefabrication construction principles become essential for trade partners to effectively critique design based on these innovative approaches. Having the capacity to effectively define different scopes of work and provide feedback on the OAC's proposal for different scopes also makes trade partners valuable in the project's design stage. Lean principles and methods application was also identified as an upcoming area that trade partners need to know how to collaborate on with the design, construction manager, and the owner's representative team.

Trade partners also need to easily identify redundancies between their design scopes and the architects' or engineers' design scopes and find ways of merging the scopes to eliminate redesign waste. The overlaps may include detailing construction documents and generating shop drawings or prefabrication detailing. Further extending the knowledge on systems to facilitate inter-trade coordination is a skill that supports collaboration of trade partners with other trade partners during the design and construction planning process. During this coordination and collaborative ideas exploration, the practitioners emphasized the need for respect and tolerance of the ideas of other trade partners. This requires open-mindedness to allow for accommodating other participants' perspectives and determining when compromises between design creativity and efficiency are required for successful progress and outcomes.

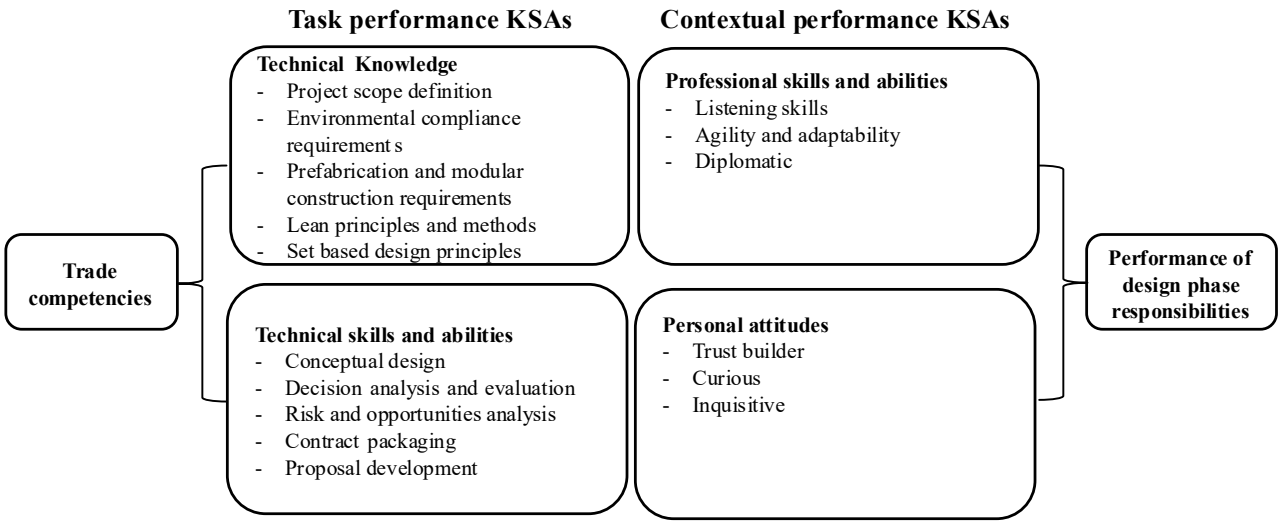

Figure 3: Additional KSAs identified from two focus group sessions with industry practitioners

Understanding collaboration principles related to Lean design and Lean principles is also becoming a fundamental requirement for trade partners to be engaged in projects implementing lean design and construction. The practitioners concurred that the technical KSAs cannot exist without the behavioral KSAs. Behavioral competencies such as effective listening skills, agility and adaptability to the less sequential design processes, ability to build trust with other team members, and building diplomatic relationships that advance the goals of the project. Competencies in implementing different lean methods such as set-based design, choosing by advantages, A3 thinking, visual planning and management, and performing target costing is also essential in effectively supporting the design process.

Conclusion

The design and construction of built assets has evolved towards a more collaborative process, with construction specialists being engaged early to contribute to design development. The knowledge construction specialists possess, both tacit and explicit, has been identified as crucial for the design process decision-making. Trade partners have more in-depth knowledge of construction systems and processes due to their direct interaction with the construction, installation, and fabrication processes and in other instances the operation processes. However, the limited studies on the specific knowledge, skills, and attributes necessary for early participation of trade partners in the design process may hinder support for effective selection of the right partners to support the design process. This study sought to identify the critical competencies trade partners need to effectively engage in the design processes. We generated a list of knowledge areas, skills, and attributes relevant to trade partners engaged in the design processes through a critical review of literature and two focus group sessions with industry practitioners.

The study identified the technical task performance knowledge and skills, and contextual fundamental contribution to design and construction process development during the design phase of the project. The KSAs were classified based on the task contextual competencies model for personnel evaluation. The task performance KSAs address the technical knowhow and ability to apply this knowledge to execute tasks and provide feedback. Some of the task performance KSAs include in-depth understanding of building components and systems is essential to effectively evaluate design alternatives. Knowledge of design

phasing and sequencing based on construction logistics requirements is also vital to technical knowledge. Knowledge of building codes and standards, means and methods for construction or installation, and providing cost or schedule feedback are also essential to provide designers with input based on proposed building layouts. Therefore, trade partners also need to know the fundamentals of cost estimation and scheduling procedures. Technical skills in specifying means and methods, analyzing the performance of components and systems, and generating cost estimates and schedules early in the design process are refined as the trades gain more experience with early involvement.

Contextual performance address, non-technical skills and behavioral attitudes of the trade partners. These require the need for strong leadership, team collaboration, critical thinking, communication, and innovative skills. These skills may be improved through experience and professional development initiatives. Behavioral attitudes such as self-motivation, flexibility, trustworthiness, confidence, and assertiveness are also essential for effectively performing responsibilities during the design process. The contextual performance KSAs have been identified as essential for effective execution of technical tasks.

Limitations

Although the KSAs identified can be used to determine the competence of trade partners for engagement in the early phase of construction projects, the validation of these task contextual competencies is based on a smaller sample size. Further validation using a larger sample of construction industry practitioners is needed to advance the generalization and characterization of these KSAs.

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