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Skillsets of Top-Performing Specialty Field Leaders: A Study of Site Superintendents, General Foremen, and Crew Leaders in the Sheet Metal and Air Conditioning Trades

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ABSTRACT

Time, cost, quality, safety, and client satisfaction are among the metrics that have been used over time to measure project performance in the construction industry. Most of these performance indicators are task/result-oriented which depend on the contribution and competence of construction workers and professionals**.** Nevertheless, the construction industry faces a labor gap due to the scarcity of skilled workforce and aging workers. Adequate measures must be put in place to meet the demands of the construction industry. Talent development and retention can be leveraged to ensure access to the skills needed for better project performance and improved productivity of the sector at large. Hence, the aim of this paper is to recognize distinctive skill sets associated with top-performing workers. This study utilized performance data based on the supervisor's rating of 88 field leaders working for Sheet Metal and Air Conditioning Contractors to identify performance characteristics peculiar to top performers. In this study, a field leader functions as a liaison between a construction project manager and a construction crew to ensure the assigned tasks are executed, and such a person may be a foreman, superintendent, or field executive. Using Principal Component Analysis, a single performance construct was developed from 22 performance criteria to assess the performance and grouping of the field leaders into two categories. From the analysis, 18.75% of the respondents were identified to be top-performing field leaders (FLs). An Independent sample t-test was carried out to determine the mean difference and statistical differences between the two groups based on the performance criteria. The top-performing field leaders outclassed the other field leaders in Performance criteria related to technical, leadership and communication, and overall job performance skills. The findings of this study can be used to devise strategic talent development initiatives and training targeted towards the development of traits associated with top performers in potential high-performing workers for better results.

Skill Sets, Workforce Development, Talent Retention, Specialty Trades

INTRODUCTION

One of the most vital resources in construction is people. The entire construction process from the project inception to planning and execution is hinged on the responsibilities and inputs of the project stakeholders. The expertise of the project team members is also a factor that affects project success. Despite the relevance of the contribution of human resources, the sector is being setback by the shortage of its most valuable resource. The retirement of the older generation, among other factors, has contributed to this labor crisis. As a result of old age, the baby boomers with adequate years of experience and skills required for construction work are leaving. The recent pandemic also impacted the employment status of the construction workforce- about 35% of the older generation retired in 2020 due to Covid-19 [21]. However, there is no commensurate inflow of

qualified younger generations to fill up these vacancies [18], which makes the hiring process a challenge for construction companies.

The workforce report from the Associated General Contractors of America portrays that specialty contracting and skilled trades firms are experiencing a greater shortage and more have difficulties in recruiting skilled employees, most especially the supervisory roles (AGC 2018). Employment statistics for supervisory roles project an estimated growth of 8% in the next 8 years, a rate faster than the average sector [5]. This expected growth implies that the labor crisis could get worse and hamper the sector's productivity, especially since supervisory roles that drive field operations are affected. Workable staffing strategies should be adopted to mitigate the risk associated with labor shortfalls in these critical job roles, including the positions of site superintendents and field leaders, crucial to project success as they manage resources and coordinate crews that carry out activities that lead up to the implementation of project objectives.

Since there is a small talent pipeline of skilled potential workers, the construction industry can focus on creating strategies to retain and develop the skills of the existing workforce to overcome labor shortages while increasing their productivity. Construction firms can implement this strategy by identifying the core competencies that drive performance. Upskilling and the development of these skills in average and below-performers have the potential to increase the productivity of the current workforce in the industry [22].

Hence, this study focused on the skillsets required by field leaders in the specialty contracting segment to be successful in their job. The competencies of top-performing site supervisors that aid project success were investigated and information from the study can be used by employers to assess the performance of their workers and help construction companies devise skill development initiatives to enhance the areas of weakness of their employees.

LITERATURE REVIEW

Recruiting workers with a specific mix of skills in the construction industry has been a challenge over the year. The different factors contributing to this challenge have been identified in previous research and literature. The scarcity of skilled people is one of the major causes of the widening talent gap. [18]'s study on the age distribution of workers in relation to workforce shortages revealed that the construction sector is losing old-experienced-skilled manpower. The demand for labor supersedes its supply because qualified workers equipped with the required skills are insufficient to replace the aging workforce [13], especially for site supervisory roles. The job outlook for construction site supervisors over the next couple of years due to retirement and exit from the industry is an indication that these conditions are expected to substantially widen. Over 41,000 job openings are predicted to be available yearly resulting from the efflux of construction professionals involved in onsite activities [5]. Delays in project schedules, increased project risks, cost overruns, issues with quality control, and reduced productivity are some of the implications of having unskilled workers in construction [11], [13], [16].

Although the potential talent pool (the young graduates) possesses the education to take on these positions, they do not possess the *mastery*, job experience, and training to deliver and sustain the industry's expectations, particularly specialty trade contracting firms [1]. [27] found out that site

supervisors with more job experience have better knowledge to overcome obstacles, meet up with clients' expectations, and optimize project outcomes.

To augment the gap in the skills needed in craft trades, [10] reported that opportunities should be made available for the current workforce to acquire training in skills that affect job and project performance. These opportunities may not be effectively utilized if the deficiencies in skills and needs of workers are not first analyzed and recognized. A planned human resource development that includes the evaluation of the performance of employees, identifying their needs, and designing customized skill development initiatives increases productivity and overall success for the organization [4].

Scheduling, understanding of work and sequencing, estimating, organization skills, knowledge of efficient construction methods, ability to manage working tools, leadership skills, mentoring, negotiation skills, and increased emphasis on safety are some of the core skills required for field supervision [6], [7], [8], [27]. While previous studies and literature reviews have identified the skills and competencies required for success by field leaders and site supervisors, there has been limited work on how their performance in these skill sets can be measured. The knowledge gap is lacking on how a single construct can be used to assess performance, taking into consideration the different skill categories needed by specialty field leaders.

METHODOLOGY

Data Collection

A web-administered survey was used to collect data of sheet metal and air conditioning contractors (SMACNA) field leaders (FLs) members. The survey questions were grouped into four categories as identified in different literature [9], [12], [24] on areas of competence required by field leaders to be successful in their job. Direct supervisors of 88 FLs completed a detailed assessment that assessed their skill sets based on the four performance measures outlined below with each category comprised of multiple questions measured on a scale of 1-10.

- **Technical Skills**: This category included the field leader's ability to identify and mitigate design errors, comply with safety policies, ability to plan and manage a project schedule, estimating expertise, and overall job knowledge, among others.
- **Leadership and Communication Skills:** This category measured the field leader's ability to take initiative, influence others, communicate, and work with the owner's representative and other project stakeholders, etc.
- **Ability to Change and Adapt:** This category was designed to assess the field leader's ability and willingness to adopt changes such as new technologies, skills, and procedures.
- **Overall Job Performance:** In general, this category measured the field leader's ability to meet scheduled timelines, repeatedly deliver profitable jobs, and the overall quality of work.

For this study, field leaders are considered as construction personnel responsible to drive site outcomes while working closely with the project manager to ensure the timely delivery of tools,

information, and material needed to support construction works on site. Field leaders include foreman, site superintendent, or a similar job title.

Data Analysis

Reliability analysis, using Cronbach's alpha, and Principal Component Analysis (PCA) were performed on the 22 questions (performance factors). PCA was conducted to reduce the performance factors to a single construct which was used as a benchmark to group the FLs into high-fliers and average performers. The validity and suitability of the performance factors for PCA were analyzed using Kaiser-Meyer-Olkin's measure of sampling adequacy and Bartlett's test of sphericity tests.

The data was further analyzed using independent t-test at 99% and 95% confidence intervals to compare the means of each performance factor of the two groups. The test was also used to determine the distinguishing skills of the top-performing FLs. Descriptive analysis and percentage difference of significant results were performed for result interpretation.

Results and Discussion

Kaiser-Meyer-Olkin's (KMO) measure of sampling adequacy value was 0.879 and the significance level of Bartlett's test of sphericity was <0.001. The value of the KMO was over 0.5 which suggests that there is a substantial correlation and relationship between the performance factor data [15]. Bartlett's test was statistically significant (p-value of <0.05) and further validated that the performance factors were ideal for PCA. Cronbach's Alpha of 0.944 showed that the data was reliable to develop the single performance construct.

PCA revealed four components that had eigenvalues greater than 1 with a cumulative variance of 72.031%. Visual inspection of the inflection point on the scree plot indicated that the component with eigenvalue -10.965 should be retained.

Descriptive Statistics of the Participants

80 of the 88 participants provided full data that was included in the analysis. The single-performance construct (SPC) scores generated from the 22 performance factors were used as a basis to categorize the participating FLs into top performers and average performers. The SPC scores ranged from 2.04 to -4.95. Participants with negative scores were automatically grouped as average-performing FLs. The *superstar* positions were defined by observing the greatest disparity [20] in the SPC scores for all the field leaders, precisely for scores that were below 0.

Table 1: Number of Participants by Performance

Categories	Number of Participants
Top Performing Field Leaders	15
Average Performing Field Leaders	65
Total	80

Table 2 presents the minimum and maximum single-performance construct (SPC) scores of the two groups of participants.

Table 2: Single Performance Construct Scores by Group of Participants

Group	n	Percent of N	Minimum SPC	Maximum SPC
Top Performing FLs	15	18.75%	0.8756	2.0407
Average Performing FLs	65	81.25%	-4.9498	0.7944

The performance scores of all performance factors for the two groups of field leaders are shown in table 3 below. The analysis indicated that top-performing FLs scored higher than average-performing FLs in all performance categories, except in "*Ability to train their replacement/duplicate themselves"*.

Table 3: Performance Scores of Top-performing and Average-Performing Field Leaders

Performance Factor	**All FLs (N = 80)**	**Top-Performing FLs (n= 15)**	**Average-Performing FLs (n=65)**
	Technical Skills		
Ability to be innovative	8.38	9.47	8.12
Ability to identify design errors	8.06	9.33	7.77
Ability to comply with safety measures	8.65	9.20	8.52
Ability to plan and manage project schedules	8.38	9.00	8.23
Effectiveness with site operations	8.65	9.67	8.42
Overall estimating ability	6.69	7.00	6.62
Understanding of appropriate methods for fieldwork	8.85	9.73	8.65
Knowledge of the tools of the trade	9.14	9.80	8.98
Overall job knowledge (technical skills)	8.96	10.00	8.72
	Leadership and Communication Skills		
Ability to work with other contractors	8.75	9.53	8.57
Ability to take initiative	9.15	9.73	9.02
Ability to work with architect and engineering teams	8.40	9.67	8.11
Ability to work with the owner and their team	8.70	9.60	8.49
Ability to influence others	8.34	9.20	8.14

Ability to train their replacement/duplicate themselves	7.75	7.47	7.82
Willingness to take accountability for their professional performance	8.86	9.07	8.82
Overall leadership and communication skills	8.456	8.733	8.392
Overall Job Performance Outcomes			
Ability to meet scheduled deadlines in a timely manner	8.78	9.00	8.72
The overall quality of work	8.94	10.00	8.69
Your overall satisfaction rating of the employee	8.74	9.27	8.62
Ability to repeatedly deliver profitable jobs	9.09	9.87	8.91
Ability to Change and Adapt			
Overall ability and willingness to adopt change	8.53	9.47	8.31

At 99% (*p*-value = <0.001) and 95% 6(*p*-value = <0.005) confidence intervals, the independent t-test confirmed that there were significant differences between the mean scores of top performers and average performers in the four performance categories as seen in table 4. The largest difference of 18% was in the *Ability to identify design errors* and the *Ability to work with the project team,* while the smallest difference was in *Overall satisfaction* (7%).

Table 4: Performance Differences between Top-performing and Average-Performing Field Leaders

Performance Factor	Mean Difference	Percentage Difference
Technical Skills		
Ability to be innovative	1.3436***	15%
Ability to identify design errors	1.5641***	18%
Ability to comply with safety measures	0.6769**	8%
Ability to plan and manage project schedules	0.7692**	9%
Effectiveness with site operations	1.2513***	14%
Understanding of appropriate methods for fieldwork	1.0872***	12%
Knowledge of the tools of the trade	0.8154***	9%
Overall job knowledge	1.2769***	14%
Leadership and Communication Skills		
Ability to work with other contractors	0.9641***	11%

Ability to take initiative	0.7179***	8%
Ability to work with project team (architects and other engineers)	1.5590***	18%
Ability to work with the owner and their team	1.1077***	12%
Ability to influence others	1.0615***	12%
Overall Job Performance Outcomes		
The overall quality of work	1.3077***	14%
Overall satisfaction	0.6513**	7%
Ability to repeatedly deliver profitable projects	0.9590***	10%
Adaptability to Change		
Ability and willingness to adopt change	1.1590***	13%

Note that the mean difference is top average performing FLs – average performing FLs
*** Significant difference at 95% Confidence Interval*
****Significant difference at 99% Confidence Interval*

Distinguishing Skillsets of Top-Performing Field Leaders

Technical Skills and Job Performance Outcomes

According to [7], the technical skills required for field supervision are grouped into safety, quality, and schedule competencies. While it is important for field leaders to have the constructability knowledge to carry out construction projects, there are other competencies that contribute to project success. As shown in table 4, top performers most likely also understand construction practices to utilize resources in order to maximize productivity on the job site. This involves working efficiently to control costs and staying on schedule while achieving a good project profit margin. [25]'s study discovered that planning of daily operations can improve profits on construction projects.

Leadership and Communication Skills

Out of the nine questions used to access this skill set category, the top-performing field leaders outclassed others in five skills associated with relationship-building and leadership. The responsibility of a field leaders entails the running of day-to-day operations on the construction site. This involves interaction and exchange of information between stakeholders, including the owner's representative, project teams (engineers, architects, sub-contractors, etc.), and skilled and unskilled labor crews. Communicating the responsibilities and tasks of construction workers is not the only reason an effective field leader should possess good relationship-building skills. Unexpected circumstances are not uncommon during construction, site supervisors can take advantage of established interpersonal relationships to timely address issues with the concerned project team member as the situation requires, to prevent those issues from impacting the project goals. Interpersonal relationships aid the open clear communication strategy [19] and decision-

making process required for project goals to be met. Good interpersonal relationship skills not only facilitate communication but essentially foster mutual understanding and trust that promotes collaboration, coordination, and teamwork for the successful execution of construction projects.

Further, the ability to influence is an essential leadership skill [26] as it correlates with one of the significant differences between a top-performing field leader and an average-performing field leader. [14] classified the influencing ability of a construction leader as a political skill- "the ability to understand others at work and to use that knowledge to influence others to act in ways that enhance one's personal or organizational objectives". A field leader as a *leader* of a construction crew should have the competence to leverage relationships to motivate and encourage crew members to accomplish desired project outcomes.

Also, *the ability to take initiative* as a problem-solving skill is needed by construction supervisors. The skill demonstrates the field leader's ability to engage proactive measures in preventing and addressing problems, to improve effectiveness in ensuring that project objectives are achieved. The results suggest that high-achieving site supervisors have the tendency to foresee unexpected challenges and create contingency plans to solve problems as quickly and efficiently as possible.

Adaptability

Past studies have identified the need to be flexible in terms of the ability to adapt and work effectively in a variety of situations as being essential for leaders in construction [23]. Unprecedented uncertainties and conditions may be unavoidable during construction and could require site supervisors to adopt new strategies to make necessary adjustments. The willingness of a field leader to adapt could also mean transitioning to unfamiliar methods, tools, and technologies to be more productive.

Performance Evaluation as a Strategy to Tackle Labor Shortage in Construction

The interdependent activities involved in construction make coordination and supervision important for project outcomes. Further, the role of site supervisors cannot be overemphasized if resources must be adequately allocated and utilized in achieving project tasks, and ultimately project goals. A major responsibility of site supervisors is to coordinate tasks and resources according to priorities and plans to maximize crew productivity. Despite the significance of this unique position, the shortage of workforce poses a threat to their contributions. The worker shortage survey analysis by the Associated General Contractors of America revealed that 80% of the participating construction firms are experiencing difficulties in hiring skilled workers, including qualified specialty trade workers [2]. The shortfall results from the retirement of the baby boomers, a smaller talent pool, competition for workers from other sectors, and an anticipated increase in the number of construction projects. The Institute of Management and Administration referred to labor shortage as "a shortage of adequately trained, skilled, and productive workers available for certain jobs" [17]. One of the most prominent causes of the shortage of labor as provided by construction firms in a report issued by the Associated General Contractors of America is that job applicants and potential hires do not have the requisite skills demanded in the industry [3].

The shortage of workers tends to negatively impact project performance and productivity [16]. The problem can be further worsened if the industry does not invest in training to empower old and new hires. Although construction firms have started to implement in-house training to hone the skills of their workers [3], however, this skill development initiative may not be effective if performance measures that directly affect construction projects are not identified. For instance, site supervisors are field personnel that rarely get time off-site, HR can adopt the performance construct to evaluate and distinguish the shortfalls in their skills. Site supervisors can benefit from tailored-made training to refine the skills that would empower them to be more productive and contribute towards projects and organizational goals. Construction companies will be able to get the most out of their employees, in terms of project productivity and implementation if their skills are improved. Hiring managers can also leverage the skillsets of top performers to predict the possibility of a potential employer succeeding in a job role. For prospects, Performance evaluation and skill development initiatives also have the potential to promote attract and retain talents in the industry. For pros

CONCLUSION

Strategies to combat challenges associated with the shortage of labor must be sought by the construction industry for it to meet present and future demands. The productivity of the sector can be improved if the gaps in the skills of the existing workforce are addressed, as well as the prospective employees in the construction sector. Using 88 Specialty FLs as a case study, this study investigated the distinguishing skills of the high-fliers. Out of the 22 performance factors, the top-performing FLs outclassed the average-performing in 17, which cut across the four performance categories-technical skills, leadership and communication skills, overall job outcome, and adaptability.

The single-performance construct developed in this study can be used by construction companies and specialty contractors to categorize and evaluate the performance of their site supervisors. Targeted and individualized training programs can be incorporated by employers into their talent development plans to improve their weak areas and boost the competence of the construction workers.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

One limitation of this study is the limited number of Specialty Field Leaders participants. Future research is suggested to expand the data pool and investigate the human factors of more Field Leaders from other specialty trades.

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