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Best Practice Strategies for Workforce Development and Sustainability in Construction

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ABSTRACT

Due to the dynamic and recurring nature of the construction operations, employee turnover rates remain relatively high. This high employee turnover rate presents challenges to the industry, the economy, and the entire society at whole. As well, this high turnover rate leads to significant shortage of skilled laborers given the reduced interests of the new generations in construction. To overcome these challenges, it is paramount to initiate a systematic process, based on research and feedback from industry experts, to attract and develop skilled employees, and then implement strategies to nurture and retain the attracted employees. A systematic process increases workforce sustainability, a measure of the extent to which a workforce is nurtured and retained. The goal of the study was two folds: (1) to identify potential strategies to assess and improve workforce development and sustainability in construction and (2) to statistically validate the identified strategies using feedback from field personnel in the construction industry. A survey process that collected data from a panel of expert and field personnel was carried out to achieve the goal of the study. The research findings led to the identification of multiple strategies contributing to workforce development and sustainability in construction; the identified strategies fell into seven workforce sustainability attributes, namely: nurturing, diversity, equity, health and well-being, connectivity, value, and maturity. This study makes a significant contribution to practice by providing a list of strategies that construction organizations could utilize to develop and sustain a skilled, motivated, and productive workforce.

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INTRODUCTION

The construction industry plays a vital role in the development of the economy. In the United States (US), the construction industry contributes approximately 6% of the Gross Domestic Product (GDP) (US Bureau of Economic Analysis). This contribution provides needed infrastructures and essential facilities (including roads, highways, hospitals, schools, houses, and bridges) and numerous employment opportunities that are essential to the development of the national economy and the welfare of the public (Al-Bayati et al. 2019). However, due to the innate characteristics of the construction industry, including the dynamic and cyclical nature of construction operations, the industry is faced with multiple challenges. Among the reported challenges are shortage of skilled laborers (Chini et al. 1999; Ho 2016; Karimi et al. 2018; Sing et al. 2018), high employee turnover rates (CPWR 2018; Thomas 2013), aging workforce (CPWR 2018), increased mental illnesses and suicide rates (Jacobsen 2013; CDC 2016), a high prevalence of employee/job burnout (Zhang et al. 2020; Yan et al. 2017).

To overcome the abovementioned challenges and address the three elements of organizational commitment (job satisfaction, job involvement, and occupational commitment), the construction industry should identify and implement effective strategies to develop a skilled workforce, and then maintain and retain the developed workforce in a systematic manner. This systematic process increases workforce sustainability, a measure of the extent to which the workforce is nurtured and retained over a selected timeframe. Sustainability places a particular attention to the social aspects of construction especially the construction workforce (Kamas et al. 2019). The overreaching goal of the present study is to identify best practices to improve workforce development and sustainability in the construction industry. To achieve the study goal, a major research question was posed: What are the potential strategies that could be utilized to enable workforce development and sustainability in construction? In addition, the present study intends to determine the level of importance of each identified strategy and its capability to improve and sustain the workforce. The identification of such strategies and determining their level of importance would contribute to theory and practice on workforce development and sustainability in construction. The identified strategies could be adopted by industry stakeholders to reduce employee turnover rates, improve employee retention rates, and increase employee satisfaction at work. All of which positively impact the construction industry by improving employee productivity, reducing management frustration, enhancing quality of work, and eventually maximizing financial profits of all construction stakeholders.

WORKFORCE SUSTAINABILITY

Sing et al. (2018) defined workforce sustainability in the construction industry as "the capacity to maintain, support, and endure the demand for and supply of construction personnel of a specific skill or trade." Similarly, Kossek et al. (2014) indicated that "a sustainable workforce" is a work community where members of the workforce are nurtured via different employment strategies and are enabled to perform well over time while also thriving in their personal and family lives. Building on prior definitions, workforce sustainability is defined by the Authors as *a property of a workforce that reflects the extent to which members of the workforce can perform their desired functions over a specific time* (Gambatese et al. 2019). A workforce may have a high or low level of workforce sustainability depending on the extent to which the workforce is nurtured and developed. A work community exhibiting a high level of workforce sustainability is expected to exhibit a high skill level and be able to retain members of the labor force for a long period of time as well as attracting new, valuable members (Sing et al. 2018). On the other hand, a work community that exhibits weak bonds where the workforce does not feel connected, nurtured, valued, and appreciated is likely to experience high turnover and low productivity rates (Gambatese et al. 2019).

Karakhan et al. (2020a) performed a qualitative analysis study to develop a conceptual model of workforce sustainability. Their study included a review of existing literature on the topic of workforce sustainability. The review of literature identified 22 scholarly publications on the topic and then utilized content and thematic analysis in order to extract key statements regarding essential qualities and characteristics of key attributes of construction workforce sustainability. The results of the study established a conceptual model for workforce development and sustainability in construction. The established model consisted of eight foundational attributes contributing to workforce development and sustainability in construction. The attributes are nurturing, diversity, equity, health and well-being, connectivity, value, community, and maturity. Figure 1 graphically depicts the identified workforce sustainability attributes. Each of the attributes describes multiple features needed for achieving desired qualities and characteristics of workforce sustainability. The definition of each attribute of construction workforce sustainability is provided in Table 1. The present study adopted this conceptual model of workforce sustainability and builds on it to identify and validate potential strategies to implement workforce development and sustainability in construction.

Developing best practice strategies for workforce sustainability is essential to improve conditions of the construction industry and overcome challenges the industry is faced with. For example, the lack of young workers' interest and high turnover rates in construction could lead to increased employee workload, lowered employee productivity, management frustration, poor quality of work, and eventually higher costs of construction projects (Thomas 2013; Bilau et al. 2015; Mohammed and Jasim 2018; Mohammad et al. 2021). High employee turnover rates imply that employees are not satisfied with their current job (Bilau et al. 2015). It is believed that employees with low satisfaction oftentimes produce poor work quality and have a higher probability of being involved in accidents on the jobsite (Al-Saffar 2020). Ahmed and Waqas (2017) examined the relationship between employee turnover rates, employee job satisfaction, and occupational injuries. The analysis results revealed statistical evidence of a positive association between employee turnover rates and occupational injuries, and a negative association between employee job satisfaction and occupational injuries (Ahmed and Waqas 2017). As previously indicated, the present study focuses on the topic of workforce sustainability in construction as it could improve conditions of the construction industry and overcome challenges the industry is faced with.

RESEARCH METHDOGOLOGY

The primary goal of the present study is to identify and validate potential strategies for workforce development and sustainability in construction. This goal can be unfolded into two objectives: the first objective is to identify potential strategies for workforce development and sustainability in construction, and the second objective is to validate the identified strategies of workforce development and sustainability by examining their statistical significance from the perspective of frontline employees. To achieve the objectives of the study, a survey process that collected data from a panel of experts and frontline field personnel in construction respectively is carried out. This approach involves descriptive and inferential statistical analyses of the collected survey responses. The expert panel survey is used to identify potential strategies that could be used to assess and improve construction workforce sustainability. Then, the identified strategies are given to field personnel (field workers and supervisors) in different work classifications across the construction industry to statistically examine their importance from the perspective of the workforce. An inferential statistical analysis is utilized to achieve the purpose of statically examining the importance of the identified strategies for developing and sustaining the construction workforce. Targeting and surveying field personnel provides assurance that the findings from the present study

are of practical implications. Details of the identification and validation of potential strategies for workforce development and sustainability in construction are described in the subsequent sections.

IDENTIFY POTENTIONAL STRATEGIES FOR WORKFORCE DEVELOPMENT AND SUSTAINABILITY (OBJECTIVE #1)

This section describes the data collection and analysis used to identify potential strategies for developing and sustaining the construction workforce (Objective #1). Previous studies have reported various strategies to enhance and improve workforce sustainability. Reported strategies include annual assessment to provide feedback and advice to employees (Piper and Madadi 2017), imposing a limit on the amount of night work and overtime (Kossek et al. 2014), recognizing and rewarding helping behaviors (Kossek et al. 2014; Piper and Madadi 2017), facilitating opportunities for professional development (Bae et al. 2019), ensuring time for relaxation and networking at work (Winwood et al. 2013), allowing employees of similar skills to trade-off workload and hours (Kossek et al. 2014), allowing employees to set their own schedule, a.k.a., job autonomy (Dai et al. 2009), attracting and retaining a skilled workforce by providing premium pay and loyalty rewards (Karimi et al. 2018), and establishing a family-friendly workplace and a work-life balance at work (JUST 2017; Lingard et al. 2017). To ensure that the present study provides conclusive and effective list of strategies for enhancing workforce sustainability, a panel of subject-matter experts is utilized for the purpose of identifying potential strategies for workforce development and sustainability in construction.

Selection of Subject Matter Expert Panel

A subject-matter expert (SME) panel is utilized for the purpose of identifying potential strategies for workforce development and sustainability in construction as previously mentioned. The experts are not selected randomly; instead, they are selected from a list of a convenient sample consisting of 67 potential experts (22 academics and 45 industry professionals) that were known to the research team at the time of the study for their involvement in workforce development and sustainability. Only individuals located in the US were considered for potential inclusion in the expert panel. The research team contacted and invited the experts, via telephone and/or email, to participate in the study. Nineteen experts indicated their willingness to participate in the study. However, only 16 experts (11 from industry and five from academia) provided the requested qualifying information and participated in the survey. Table 2 lists the qualifications of the expert panelists. The majority of the expert panelists (11 out of 16) are industry professionals, ensuring

that the feedback received from the panel is of practical importance. As it can be seen from Table 2, the expert panelists have the education and expertise needed to ensure meaningful and practical feedback. For instance, Expert Panelist #10 is an industry professional who has a master's degree in Civil Engineering and 37 years of professional experience in construction. In addition, this individual is a registered professional engineer (P.E.), has authored two relevant publications, and occupied two leading positions that involved mentoring and supervising over 6,800 employees. One of the positions was an employee development leader in a major construction company in the US. It should be mentioned that information about the years of experience of the individuals on workforce development and training was also collected but not listed in Table 2 since it is not a required qualification to determine whether an individual is an expert or not (Hallowell and Gambatese, 2010). Based on the collected data, all individuals except 11-I have more than five years of experience in workforce development and training.

Expert Panel Survey

After identifying and selecting a panel of subject-matter expert, a questionnaire survey was developed to collect feedback from the experts about potential strategies to improve the eight attributes of construction workforce sustainability illustrated in Figure 1. Potential strategies could be any *practices, procedures, and policies* that an organization or a company could implement to enhance the level of workforce sustainability within the organization or the company. For example, a stretch and flex program, pre-employment drug and alcohol screening, daily toolbox meetings, annual safety trainings, and periodic wellness and health check-ups are potential strategies that an employer can implement to ensure members of the workforce are safe and healthy, promoting a high level of workforce sustainability within the company (Rajendran 2006; AGC 2018; Karakhan et al. 2020b).

The questionnaire includes open-ended questions asking the experts about potential strategies to enhance each of the eight identified attributes (nurturing, diversity, equity, health and well-being, connectivity, value, community, and maturity). It should be mentioned that the definitions of workforce sustainability attributes shown in Table 1 were presented to the expert panel before collecting their responses. The questionnaire was administered virtually using a third-party platform. The questions asked in the questionnaire aimed to identify strategies that could be used for workforce development and sustainability in the construction industry. To be specific, one of the questions stated: What strategies can be used to assess and improve each of the eight workforce

sustainability attributes?. The meaning of the term "strategy" was described to the survey participants before asking the survey questions. As previously stated, a strategy could be any *practice, procedure, and policy* that an organization or a company could implement to enhance the level of workforce sustainability within the organization or the company. After receiving and analyzing the questionnaire responses, it is found that 282 potential strategies are recommended by the panel to enhance the abovementioned attributes. To reduce the list of strategies, the research team analyzed the recommended strategies and grouped similar strategies. Following this process, a list of 54 strategies is recognized; in addition, the research team added seven strategies reported in literature to be effective strategies for enhancing workforce sustainability. The seven reported strategies in literature are: having a periodic company newsletter (Vecchio-Sadus and Griffiths 2004), having a policy to improve employee happiness (JUST 2017), having a policy to nurture local community at work (JUST 2017; Valdes-Vasquez and Klotz 2013), having a world-class safety policy (CSR Report 2017), providing a union-friendly workplace (JUST 2017; Ho 2017), having a policy to allow for workload trade-off (Kossek et al. 2013), and having a policy to enhance workforce integration within the industry (JUST 2017; Kossek et al. 2013; Valdes-Vasquez and Klotz 2013). Adding the seven strategies to the initial list of 54 strategies produced a list of 61 potential strategies that are believed to positively influence workforce development and sustainability in construction.

The research team then returned the list to the expert panelists and asked them two main questions. The first question asked the panel members to rate the influence of the 61 potential strategies on achieving a high level of workforce sustainability using a five-point Likert scale where "1" is low influence, "2" is minor influence, "3" is moderate influence, "4" is high influence, and "5" is extreme influence. The question stated: What is the level of influence of each strategy on achieving its applicable attribute of workforce sustainability using the 5-point Likert scale and methodology referred to hereinbefore?. The second question asked the panel to suggest whether each strategy is essential or auxiliary to achieve a high level of workforce sustainability. In other words, the survey participants were asked if each strategy should be labeled as

Essential strategies refer to those practices, procedures, and policies that are required to achieve workforce development and sustainability, while auxiliary strategies are elective and preferred but not required practices/procedures/policies to achieve workforce sustainability (Gambatese et al.

2019). After collecting the responses from the expert panel, a descriptive statistical analysis is performed to find the median and standard deviations of the level of influence of each strategy. The median is used in this case as a measure of centrality as opposed to the arithmetic mean due to its resistance to outliers as recommended by Mitchell (1991) and Hallowell and Gambatese (2010). The analysis criteria and findings from the expert panel survey are discussed in the subsequent section.

Confirmed Potential Strategies for Workforce Development and Sustainability

To reduce the list of the most important strategies that could be used for developing and sustaining the construction workforce, two criteria were utilized. For the purpose of this study, only strategies that were rated by the expert panel as to be *highly influential* (i.e., median ≥ 4) and labeled by at least 50% of the panelists as *essential* for achieving workforce sustainability were selected. Reducing the list of strategies to a reasonable number is essential to ensure diffusion of the study findings among industry stakeholders. Previous research studies have mainly relied on two methods to determine which strategies are the most important and which strategies should be given less importance. The first method is to use frequency (i.e., the number of times a strategy is reported), and the second method is to use statistical analysis, either descriptive or inferential (Cox et al., 2003; Gambatese and Hallowell, 2011; Podgórski, 2015; Karakhan et al., 2018; Gambatese et al., 2019). The protocol used in this study is a combination of both methods in which it relied on descriptive statistical analysis (i.e., only strategies that received a median rate of 4 or more) and a frequency analysis (i.e., only strategies labeled by 50% of the expert panel). It should be acknowledged that this decision may have excluded some important strategies for workforce development and sustainability in construction but deemed necessary to create a list of the most relevant and important strategies for construction workforce development and sustainability. Following the abovementioned criteria, 24 confirmed potential strategies are recognized as shown in Table 3 as most relevant for developing and sustaining the construction workforce. The descriptions of the identified strategy are provided in the table which were taken from previous studies and scoped by the expert panel and the research team. For example, “productive performance appraisals” were rated by the panel as “highly influential” on impacting construction workforce sustainability and labeled as “essential” to achieving workforce development and sustainability in construction. More specifically, productive performance appraisals are believed to play an essential part of employees’ career development and motivating the workforce to create

a nurture community at work. This finding is consistent with previous studies on the topic which found productive performance appraisals to have a level of high influence on developing and sustaining a productive workforce (Kuo and Chen 2008; Potter and Smith 2009; Neyestani 2014). It should be mentioned that none of the seven strategies suggested for developing and sustaining a strong community at work – a periodic company newsletter, a policy to improve employee happiness, a policy to nurture local community at work, a world-class safety policy, a union-friendly workplace, a policy to allow for workload trade-off, and a policy to enhance workforce integration within the industry – which fall under the "Community" attribute of workforce sustainability was found to be of high influence for developing and sustaining the construction workforce according to results from this study.

VALIDATE POTENTIONAL STRATEGIES FOR WORKFORCE DEVELOPMENT AND SUSTAINABILITY (OBJECTIVE #2)

This section describes the survey process used to validate the potential strategies identified by the expert panel and examine their statistical significance on achieving a high level of workforce sustainability from the perspective of field personnel (Objective #2).

Survey Development and Sample Demographics

To verify the importance of the identified potential strategies for workforce development and sustainability described in Table 3, a survey questionnaire was designed and distributed to construction frontline employees across the US. The questionnaire survey consisted of two primary parts. The first part of the questionnaire captured key demographic information such as trade, type of organization, location of organization, and experience; while the second part provided participants with an opportunity to rate each strategy using a five-point Likert scale. The survey was developed in Qualtrics (2020) and distributed to construction workers through the Qualtrics online platform. Given the reputed poor response rate to survey questionnaires in the US construction industry (Bröchner and Badenfelt 2011), and the need to ensure that diverse insights were included in the validation process, the researchers opted to engage a third-party platform (Qualtrics Panel) to administer the distribution of the survey. Qualtrics Panel is a professional service provided by Qualtrics focused on supporting researchers with timely dissemination of surveys to a specific target audience. Previous construction-related studies have successfully utilized third-party platforms such as Qualtrics Panel (Azeez and Gambatese 2019; Nnaji and Karakhan 2020). Participation in the survey was voluntary. The survey

included sieves and quality checks to remove individuals not involved in the construction industry, non-frontline workers, and responses of low quality. The survey was distributed to approximately 1,300 construction employees, and 143 frontline workers and supervisors participated in the survey, yielding a response rate of approximately 11% which is low but not atypical for construction research (Abowitz and Toole 2010).

Out of the 143 responses received, 21 responses were rejected due to incomplete information or quality concerns (e.g., straight lining answers), yielding a final number of 122 participants. As shown in Table 4, the participants who completed the survey were either frontline workers (carpenters, masons, electricians, etc.) or frontline supervisors (foremen and superintendents). The number of frontline workers (80 participants) was almost double the number of frontline supervisors (42 participants), while more than half of the responses were received from General Contractors and 25% of responses were from contractors located in Southeastern US.

The study participants have had many years of professional experience in the construction industry. Only one participant (0.82%) had less than one year of professional experience; 10 participants (8.20%) had 1-5 years of professional experience; 41 participants (33.61%) had 6-10 years of professional experience; 24 participants (12.67%) had 11-15 years of professional experience, 20 participants (16.39%) had 16-20 years of professional experience; 10 participants (8.20%) had 21-25 years of professional experience; and 16 participants (13.11%) had more than 25 years of professional experience in the construction industry. The median number of professional years of industry experience of the study participants is 15 with 14 being the average years of industry experience for frontline workers and 19 is the average years of industry experience for frontline supervisors. These numbers indicate the high level of professional experience of the study participants. Most of the study participants are involved in residential (63.11%) and commercial (25.41%) construction projects. The study sample involved both genders (male and female individuals). Twenty-five participants (20.45%) were female frontline workers/supervisors which is significantly higher than the percentage of women in the construction industry. According to the latest statistics by CPWR (2018), the number of female construction personnel was approximately 10% in 2017. Furthermore, a wide range of ethnicities were represented in the study sample including Caucasians, Latino Hispanics, Black/African Americans, Asians, and Native Americans.

Validation Process and Analysis

To reiterate, the purpose of the validation study is to examine the statistical significance of achieving a high level of workforce sustainability using feedback from frontline employees on construction sites (Objective #2). To achieve this purpose, the survey participants were asked to indicate the importance of the 24 confirmed potential strategies (described in Table 3) to achieving a high level of workforce sustainability using a five-point Likert scale ("1" not important at all, "2" low importance, "3" neutral, "4" moderate importance, and "5" high importance).

A non-parametric statistical analysis consisting of a one-sample Wilcoxon Signed Rank test is carried out to determine the statistical significance of each strategy for achieving workforce sustainability. A non-parametric one-sample test is selected because the data did not meet the normal probability distribution requirement needed for most parametric statistical analyses. Under the selected test, the null hypothesis is that the identified strategies are not effective on achieving workforce sustainability from the perspective of the workforce, while the alternative hypothesis is that the identified strategies are effective on achieving workforce sustainability from the perspective of the workforce. In this case, if there is statistically significance evidence that the median value is greater than 3, the tested strategy is identified as effective for achieving workforce sustainability from the perspective of the workforce. On the other hand, if there is not statistically significance evidence that the median value is greater than 3, the tested strategy is believed to not be effective for achieving workforce sustainability according to the perspective of frontline personnel in construction. In addition, a mean normalization is conducted to further investigate the critical strategies for achieving workforce sustainability. Developing a mean normalization score (MNS) involves assessing the importance of each strategy relative to other strategies being evaluated as shown in Eq. (1).

$$\mathrm{MNS} = (\mathrm{Actual\ Value} - \mathrm{Min.Value}) / (\mathrm{Max.Value} - \mathrm{Min.Value}) \quad \ldots (\mathrm{Eq.\ 1})$$

Several studies in the field of construction have utilized mean normalization score to identify critical factors that influence decision-making (Adabre and Chan, 2019; Nnaji et al. 2020; Osei-Kyie and Chan 2017). The MNS ranges from zero to one. As the value of MNS increases, its significant increases meaning that it is likely that the mean value

To determine critical factors or strategies, previous studies have recommended that those factors/strategies with an MNS equal to or greater than 0.5 should be retained as critical factors/strategies (Chan et al. 2018).

Validation Results – Validated Strategies for Workforce Sustainability

The inferential statistical analysis discussed in the previous section examines whether each strategy is effective for achieving workforce sustainability from the perspective of frontline employees. According to the Wilcoxon Signed Rank test, if the *p*-value is equal to or less than 0.05, then there is statistically significant evidence that the tested strategy is perceived as effective for achieving workforce sustainability from the perspective of the workforce (Starnes et al., 2003). On the other hand, if the *p*-value is greater than 0.05, there is not enough statistical evidence to reject the null hypothesis that the tested strategy is not effective for achieving workforce sustainability.

As shown in Table 5, all strategies, with the exception of "Employee stock ownership program," received a median rating of at least 4.00 (moderately important) and recorded a *p*-value less than 0.01, thereby suggesting that frontline employees believe these strategies are essential for improving workforce sustainability in construction. Results from the mean normalization (MNS) largely concur with the one-sample test. In addition to "Employee stock ownership program," the MNS process flagged "Onboarding process" as a non-critical strategy for achieving workforce sustainability. When comparing between the responses of frontline workers and frontline supervisors on the attribute level, no substantial evidence was observed, indicating that frontline supervisors and workers share similar views on the importance of relevant strategies for developing and sustaining the construction workforce. At an attribute level, frontline employees assigned a median rating of 5.00 (i.e., highly important) to "Equity," "Health and Wellbeing," and "Value," while other attribute categories received a rating of 4.00 (i.e., moderately important).

Except for "Safety and health program," there was no statistical difference between the responses received from frontline workers and supervisors (*p*-value = 0.048). However, it is interesting to note that frontline supervisors rated the workforce sustainability strategies slightly higher that frontline workers, with the exception of "Equitable pay across organization." Frontline supervisors indicated that 50% of the strategies listed and assessed in this study are of high importance (median value of 5.00), while frontline workers rated only 12.5% of the identified strategies as highly important (Non-discrimination policy; Equitably pay across organization; and Zero-injury goal).

These findings indicate that all identified strategies listed in Table 3 except for "Employee stock ownership program" are effective and reliable strategies for developing and sustaining the construction workforce. Validating the findings from the expert panel survey with feedback from frontline construction employees ensures that the present study is of practical implications and such findings can be utilized by construction stakeholders to support the workforce in the construction industry and enhance the industry outcomes.

DISCUSSION OF RESULTS

The goal of the present research study was to identify strategies for achieving workforce development and sustainability in construction and then validate the identified strategies with feedback from frontline construction employees. A survey process that collected data from a panel of experts and field personnel across different work classifications in construction was carried out to achieve the goal of the study. As listed in Table 3, 24 strategies identified by the expert panel as essential for and highly/extremely influential on achieving workforce development and sustainability in constriction. Out of the 24 identified strategies by the expert panel, 23 strategies were perceived by frontline employees in construction (both workers and supervisors) as important to them to achieve workforce development and sustainability. Only "Employee stock ownership program" was not viewed as an important strategy for achieving workforce development and sustainability from the perspective of frontline employees in construction. This section provides an attribute level discussion and highlights the significant findings from the statistical analyses presented beforehand.

Nurturing: As previously indicated, the "Nurturing" attribute focuses on the extent to which an employee of an organization of a company feels supported, educated, and trained in their work. Insights from the expert panel, frontline workers, and frontline supervisors show that providing timely appraisals and feedback and appropriate professional training is critical to retaining and sustaining the construction workforce. These strategies are rated highly by the surveyed field employees (one sample test p-value < 0.01, MNS > 0.5).

Providing timely feedback to a worker regarding his/her productivity performance goes a long way in helping the worker set appropriate goals and targets (Garg and Rastogi 2006; Kossek et al. 2014). Moreover, providing such feedback ensures that the organization and the employee have

an aligned understanding of the work expectations, which enhances transparency and builds trust over time. Providing workers with access to development opportunities such as professional and skill-based training was considered an important strategy for enhancing workforce sustainability (one sample test p-value < 0.01, MNS > 0.5). The need for technical training cannot be overemphasized. Previous studies have detailed the impactful role that training can have on a worker's job satisfaction (Das and Baruah 2013; Hytter 2007). Although worker training could be expensive at first, employers typical see a return on this investment within a short period of time (Phillips 2012). Contractors are encouraged to invest in providing useful technical training to employees to help increase retention rates. Innovative trainings such as virtual reality training is proven to be of even higher effectiveness level in helping employees digest the message of the training, understand its technical content, and utilize methods/techniques learned in the training to improve their performance (Acar et al. 2008). This professional training could also be in response to an observed productivity performance deficiency. Organizations are more likely to report higher job satisfaction and lower retention rates if workers believe their employer is invested in helping them develop and improve their performance (Gambatese et al. 2019).

While participants' ratings for "Onboarding process" were significantly greater than the threshold (median value of 3.00) on average, the MNS was less than the 0.5 threshold. Based on this result, organizations could focus on or implement "Performance appraisals" and "Professional training opportunities" if resources are limited. However, as suggested by previous studies (Hal-Ellis 2014; Graybill et al. 2013), "Onboarding process" typically increases the sustainability of a workforce and, therefore, construction organizations are encouraged to implement such a process.

Diversity: Multiple previous studies have highlighted the lack of workforce diversity in the construction industry (Navarro-Astor et al. 2017; Sang and Powell 2012; Karakhan et al., 2021). Challenges related gender, ethnicity, disability, sexual orientation, language, and age have been frequently reported throughout the construction industry, impacting the experience of the construction workforce negatively (Powell and Sang 2013). The overwhelming majority of the construction workforce is male individuals. A recent study by Hickey and Cui (2020) discovered that women only occupy 3.9% of executive positions in the construction industry. However, the Institute for Women's Policy Research (IWPR) suggests a growing gender diversity within the frontline workforce (IWPR 2019). Approximately 70% of people of color working in the

construction industry in the United Kingdom (UK) reported concerns about their career progression and a perception that they would be discriminated against based on their race, sexual orientation, or age (Balch 2019). This unfortunate perception of the construction employees is shared by the construction workforce in the US as well (Karakhan et al., 2021). In the US, recent studies have found that 76% of Black and 77% of Asian employees in construction believe that they have less opportunities for career progression because they are people of color (Hatcher and Hawkins 2021). For instance, frontline workers believe that their leaders are biased toward individuals of the same ethnicity, sexual orientation, and age (Balch 2019).

The present study provides strategies to help industry stakeholders mitigate the abovementioned challenges and enhance workforce diversity in the construction industry. These strategies are in line with previous studies on the topic (Gomez and Bernet 2019; McKay et al. 2007). As listed in Table 5, the three strategies associated with diversity (Diverse and inclusive work environment, Diverse and inclusive frontline leadership, and Diverse and inclusive frontline employees) are all considered to be critical for improving employee retention, thereby showing empirical evidence supporting the critical role diversity plays in workforce sustainability (one sample test p-value < 0.01; MNS > 0.5).

Based on this result, employers in the construction industry should give high priority to developing and growing an inclusive and diverse work environment. This goal could be achieved through (1) aligning diversity initiatives with cooperate strategic goals and making diversity part of the executive's key performance indicators, (2) evaluating the organization periodically to determine the level of diversity across all work levels relative to a certain benchmark (e.g., similar organizations in the construction industry or elsewhere) using diversity assessment tools, (3) increasing education on diversity, (4) establishing mentorship programs to increase retention of minorities in different roles, (5) encouraging cross-training programs to increase exposure of minorities to different roles within the organization or the company, and (6) broadening recruitment efforts beyond a specific geographical region. It should be noted that sustaining the workforce requires attention to diversity during higher education especially among senior and upper graduate students (Hamlet et al. 2020).

Equity: Alongside diversity and inclusion, equity has received significant attention in several industries. Researchers allude that equity is a vital element of workforce sustainability and, in order to achieve organizational success, it should be emphasized by the leadership of the organization

(Terera and Hgirande 2014; Hickey and Cui 2020). Responses received from frontline workers and supervisors indicate that equity is an essential attribute needed to retain workers in the construction industry. Interestingly, "Equity" is the only attribute that received a median rating of 5.00 by both groups (frontline workers and supervisors) indicating that this attribute is of high importance for achieving a high level of workforce sustainability based on the perspective of frontline employees.

The four strategies listed under "Equity" are highly rated by frontline workers and frontline supervisors (one sample test p-value < 0.01, MNS ranging from 0.68 to 0.95). This result confirms the importance that employees place on equity in the construction workplace. Organizations should develop a clear corporate policy focused on preventing discrimination within the organization. Beyond developing a policy, organizations should ensure that each worker within the organization is aware of the policy and plays a positive role to enforce the policy. This goal could be achieved through including a section on equity in onboarding and refresher trainings, regular evaluation of pay structures and assessment of potential pay-based discrimination, fair and transparent protocols to evaluate cases of discrimination, and making hiring and promotions transparent.

Based on the findings of the present study, organizations that incorporate and emphasize the need for equity as a key component of their organizational culture could observe lower turnover and higher worker retention rates. These findings are supported by previous literature on the topic (Chih et al. 2017).

Health and wellbeing: The wellbeing, safety, and health of employees is a key performance indicator for most contractors in the construction industry. Regardless, the industry annually records high numbers of injuries and fatalities and is ranked as the most dangerous industry in terms of number of fatality (BLS 2017). Moreover, recent data indicates a high rate of mental illnesses within different trades across the construction industry, which comes at a significant cost to the industry (Milner et al. 2015; CDC 2016). In addition to driving down direct costs associated with accidents (e.g., compensation cost and medical bills), developing and implementing strategies that cultivate a positive safety culture and prioritize the safety, health, and wellbeing of employees is critical to improving employee retention rates.

Results from the present study indicate that employees who are exposed to the highest level of safety risk in construction associate the safety and health management program of an organization

with workforce sustainability. Based on the study results, organizations could improve workforce sustainability if they have a zero-injury policy, comprehensive and effective safety program, and safety and health training requirements (one sample test *p*-value < 0.01, MNS ranging from 0.89 to 1.00). Frontline supervisors rated this attribute as highly important with all strategies within the attribute receiving a median score of 5.00. Frontline supervisors observe, firsthand, the impacts accidents have on their ability to successfully manage tasks at work. Therefore, contractors should prioritize developing and maintaining a positive safety culture and ensure frontline supervisors are an essential component of the decision-making process especially on decisions regarding worker safety. The use of innovative methods and technological advances are also recommended by previous research in order to preserve the health and safety of the construction workforce (Karakhan and Gambatese 2017). As well, it is imperative to formulate management response and post-disaster plan to health and safety challenges such pandemics (Nnaji et al. 2022).

Connectivity: Providing a work environment that promotes connection and collaboration among employees plays a key role in improving employee retention (Council 2004). When employees feel connected to their peers, management, and the organization as a whole, they are more likely to remain in the organization for a relatively longer period of time (Council 2004). Similar to previous studies, results from the present study indicate that involving employees in decision-making and promoting regular meetings with supervisors are effective strategies for workforce development and sustainability. To ensure that each employee's talent is maximized, the early involvement of employees in decision-making is a key component of more innovative and progressive project production systems such as lean construction.

While the strategies "Involving workers in decision-making" and "Regular meetings with supervisors" were important to both frontline workers and supervisors (one sample test *p*-value < 0.01), responses received from the study participants indicate that "Employee stock ownership program" is not a significant strategy for developing and sustaining the workforce (one sample test *p*-value = 0.37; MNS = 0.00). It is important to note that contrary to the field worker's rating, the expert panel (composed of primarily management level employees) believe that having an employee stock ownership program is a key factor that increases connectivity and promotes workforce sustainability within the organization. One potential reason for this outcome could be that most frontline employees with the exception of superintendents are typically transient

employees (e.g., union workers) with limited exposure to or affinity towards employee stock ownership programs. Therefore, construction organizations with largely management-related employees (e.g., mid-sized to large general contractors) could provide a stock ownership program to their employees while smaller companies do not have to prioritize such aprogram if the primary intention is to boost workforce sustainability.

Value: Another critical attribute of workforce sustainability is cultivating an environment that ensures employees of an organization or a company feel appreciated and recognized for their work performance, contributions, and loyalty. Results from the present study indicate that the five strategies within the "Value" attribute (providing health insurance and retirement plan, providing family resources, encouraging policies that support work-family/life balance, prioritizing job stability and retention, and providing performance feedback/appreciation) are all important for achieving a high level of workforce sustainability (p-value < 0.01; MNS ranges from 0.59 to 0.76). As traditional work roles and processes evolve, it is critical that contractors provide additional resources aimed at promoting healthy lifestyle options and supporting work-life balance for their employees. For instance, contractors could provide health insurance and wellness plans, encourage flexible working hours, provide childcare subsidies, paid maternity leave, and protected paternity leave as well as host family-centric events. These actions, among others, provide a work environment that recognizes the value of each employee.

Maturity: An organization is only as good as its employees. Growing the capability of employees and their leadership and communication abilities is an important element of successful companies and considered a worthy investment. In fact, research suggests that organizations could reap a return on investment (ROI) above 200% if skilled workforce is developed and maintained (Avolio et al. 2010). One reason for the high ROI is the elimination or reduction of cost associated with replacing an employee, which could cost the employer as high as $18,000 per each replacement according to findings from O'Connell and Kung (2007). These results are supported by findings from the present study; to be specific, frontline employees who participated in the study survey indicated that their employer's policies and actions towards their skill development and leadership growth are key factors that impact their intention to continue working for that employer or decide to leave (one sample p-value < 0.01; MNS ranging from 0.61 to 0.93). Employers are encouraged to have formal policies in place for promoting leadership and communication training (e.g.,

professional growth through licensure), and a clear set of expectations for career progression in all positions.

CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

Although the construction industry plays a critical role in growing the economy of most countries, the industry, especially in developed countries such as the US and UK, is beginning to observe significant turnover rates and severe shortage of skilled workforce. These circumstances necessitate a more robust approach for construction workforce development and sustainability. The present study aimed to identify strategies for achieving workforce development and sustainability in construction by collecting data through two surveys from a panel of experts and frontline employees (both workers and supervisors) in the construction industry. The panel of experts represented the perception of top management in construction while frontline employees represented the perception of the construction workforce. The collected responses were analyzed using a combination of qualitative and quantitative statistical analysis techniques. The responses collected from an expert panel consisting of 16 construction stakeholders revealed a list of 24 potential strategies that could be used for construction workforce development and sustainability. These 24 potential strategies fall into seven attributes of workforce sustainability reported in literature, namely nurturing, diversity, equity, health and well-being, connectivity, value, and maturity. To validate the identified potential strategies, a survey of 122 frontline employees was carried out in which all strategies except “Employee stock ownership program” were confirmed as essential and influential on developing and sustaining the construction workforce. In summary, the following statements are recommended as potential ways to achieve workforce development and sustainability in the construction industry:

I. Contractors are encouraged to invest in providing useful technical training to employees targeted at meeting specific growth needs identified by supervisors in consultation with employees. Organizations should promote professional training as well as developing and implementing robust and transparent performance appraisal systems.
II. Employers should prioritize developing and growing an inclusive and diverse work environment through the alignment of diversity initiatives with cooperate strategic goals and periodic evaluation of the organization’s diversity across all work categories.

III. Organizations should develop and enforce a clear corporate policy focused on preventing discrimination within the organization and ensure that employees within the organization are aware of such a policy.

IV. Contractors should continue to prioritize developing and maintaining a positive safety culture and include frontline employees as key stakeholders in safety-related decision-making.

V. Contractors should provide wellness plans, promote family centric activities, permit flexible working hours when possible, and pay and protect maternity/paternity leaves.

VI. Employers are encouraged to have written and transparent policies in place for sponsoring leadership and communication training, professional growth, and a clear set of expectations for attaining promotion to all positions.

This research findings provide a practical and theoretical contribution to the body of knowledge on workforce development and sustainability. Adopting and implementing the identified strategies is expected to help enhance workforce development and sustainability in practice throughout the construction industry. If a significant number of construction companies implement some or all of the identified strategies, a more nurtured and connected workforce could be attained throughout the industry, leading to reduced employee turnover rates, improved job satisfaction, and improved capability to attract new and highly talented employees; all of which is expected to improve production outcomes in the construction industry in terms of cost, quality, schedule, and safety. Similarly, this research contributes to current construction management literature on workforce development and sustainability by identifying and validating a list of effective strategies to develop and sustain a skilled, motivated, and productive workforce. Future research could build upon this study to provide a more comprehensive list of workforce development strategies that are specifically tailored to a particular occupation or a trade. The implication of the present research is for the construction workforce itself but the actions to develop and sustain the workforce must be essentially made by organizations and contractors. Developing and sustaining the construction workforce can be achieved by adopting and implementing the identified strategies listed in Table 5.

It should be mentioned, however, that the study has limitations in a few aspects. First, the sample size of the present study is limited and does not include insights from middle management. Future studies on workforce sustainability should utilize a larger and broader sample to assess the impact of these strategies and attributes on employee retention especially from the perspective of middle

management. This expanded sample would provide researchers with an opportunity to conduct detailed demographics-based statistical analysis. Second, the present study did not solicit employee responses on strategies associated with "Community" due to the fact that the expert panel did not rate the community-based strategies as influential or highly influential on achieving workforce development and sustainability. It is important to note that some employees may consider this attribute as an essential component of an attractive workplace. This perspective and preference could be particularly true for Generation Z employees (Singh and Dangmei 2016). Future studies on workforce sustainability should assess the potential role of "Community" on job satisfaction and employee retention rates. Third, the present study did not explore the cost implications and labor hours needed to adopt and implement the identified workforce sustainability strategies. Some strategies may be more expensive and difficult to implement in practice. In such cases, the desire to adopt and implement these strategies would be low impacting the overall workforce sustainability outcomes. Future studies on the topic should consider the cost implications and effort needed to adopt and implement the identified workforce sustainability strategies. Fourth, the statistical process used did not involve a correction analysis and, therefore, the possibility of a confirmation bias in the study findings cannot be totally eliminate. Such a correction analysis is used to reduce the chances of obtaining type I error (a false-positive error) and is essential for certain post-hoc statistical analyses such as pairwise comparisons. In the case of this study, no pairwise comparisons or any other post-hoc analysis was conducted. In addition, the results showed overwhelming statistical evidence (p-value < 0.01) of the significance of the identified strategies for workforce development and sustainability. Accordingly, there was no essential need for a correction analysis.

DATA AVAILABILITY STATEMENT

All data, models, or code that support the findings of this study are available from the corresponding author upon reasonable request.

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Table 1: Definition of workforce sustainability attributes

Attribute	Definition
Nurturing	The extent to which employees of a company or an organization feel supported, educated, and trained in their work.
Diversity	The extent to which the workforce is diversified and inclusive where every member of the workforce is respected and fully utilized.
Equity	The extent to which employees of a company or an organization feel that they are equally treated and fairly evaluated without any discrimination of any kind.
Health and Wellbeing	The level of mental and physical health and safety in the workplace that members of the workforce feel and experience.
Connectivity	The degree to which the workforce feels connected to their peers and managers, and actively engage in leadership, planning, and decision-making activities.
Value	The extent to which employees of a company or an organization feel appreciated and recognized by their employer for their work performance, contributions, and loyalty.
Community	The extent to which employees of a company or an organization experience camaraderie and companionship in their work community.
Maturity	The extent to which members of the workforce are developed and competent where they have adequate capabilities to bear responsibility and accountability.

Source: Data from Karakhan et al. (2020a)

Table 2. Qualifications of the expert panelists

Expert Panelist	Education	Professional experience (years)	Professional registrations (count)	Relevant publications (count)	Leading positions (count)
1-A	PhD	18	2	9	1
2-A	PhD	14	0	9	0
3-A	PhD	29	1	200	2
4-A	PhD	15	2	38	1
5-A	PhD	28	0	201	3
6-I	BA	15	1	0	0
7-I	BS	8	2	0	3
8-I	MS	20	1	0	2
9-I	BA	16	2	0	0
10-I	MS	37	1	2	2
11-I	MS	5	0	2	0
12-I	MS	40	1	2	0
13-I	MS	35	1	0	1
14-I	MS	30	0	0	1
15-I	MS	15	1	0	1
16-I	BS	40	0	9	0

Note: "A" stands for academic, and "I" stands for industry professional.

Table 3. Confirmed potential strategies for workforce development and sustainability

Attribute	Strategies	M	SD	Description
1.0 Nurturing	1.1 Productivity performance appraisals	4	0.72	Have a procedure in place to document and evaluate employees' current and past performance and provide feedback for improvement
	1.2 Professional training and development	4	0.78	Provide opportunities for technical training and professional development by dedicating an annual fund of at least 1% of payroll
	1.3 Onboarding process	4	0.72	Provide a formal orientation and mentorship plan to all new employees supervised directly by upper management and human resources professionals
2.0 Diversity	2.1 Diverse and inclusive work environment	4	1.06	Have a formal and written policy statement on diversity and inclusion signed by the chief executive officer and/or other senior corporate officers
	2.2 Diverse and inclusive frontline management/ leadership	5	1.03	Have a balanced management and leadership staff with reference to current state census data on gender, race, and ethnicity
	2.3 Diverse and inclusive front-line employees	4	0.87	Have a balanced workforce with acceptable deviations from current state census data on aggregated Caucasian and non-Caucasian ethnicity and racial demographics
3.0 Equity	3.1 Non-discrimination policy	4	1.04	Have a formal and written policy statement on equality, justice, and non-discrimination in the workplace that are signed by the chief executive officer and/or other senior corporate officers
	3.2 Transparency	4	0.82	Have a full disclosure policy regarding financial aspects and salaries of all employees including management and senior leadership staff
	3.3 Equitably pay/compensation across organization	4	1.09	Have a policy in place restricting pay discrepancy to 1:3 within job classifications and 1:20 across job classifications within the organization
	3.4 Merit based recruitment and promotion process	4	0.60	Have a well-documented and formal process regarding recruitment and promotion of individuals that are accessible to all employees
4.0 Health and wellbeing	4.1 Zero-injury goal	4	0.94	Adopt a zero-injury policy that aims to eliminate workplace injuries and fatalities

	4.2 Safety and health program	4	0.58	Implement a world-class safety and health program and receive (or aim to receive) recognition in OSHA's Voluntary Protection Program (VPP) or other equivalent programs for organizations located outside the United States
	4.3 Safety toolbox and meetings	4	0.58	Provide OSHA 10-hour training to all field employees and OSHA 30-hour training to all field supervisors as well as daily toolbox meetings especially before major tasks
5.0 Connectivity	5.1 Involve workers in decision making	4	0.62	Implement ways to facilitate worker involvement in decision-making including roundtable events where employees can connect with both peers and leadership and provide insights before decisions are made
	5.2 Regular meetings with supervisors	4	0.75	Implement formal face-to-face meetings between workers and their supervisors held at a specific, pre-scheduled time
	5.3 Employee stock ownership program	4	1.07	Have a successful employee stock ownership program (ESOP) with no up-front cost
6.0 Value	6.1 Health insurance and retirement plan	4	0.50	Provide a comprehensive health insurance plan (medical, dental, and vision) to employees and their families as well as a retirement plan (with employer match or contribution) for all employees attaining a certain age
	6.2 Family resources	4	0.89	Provide family friendly resources to support employees and their families including childcare support/subsidy, family education support, family events, and flexible work arrangements when there is a family need or emergency
	6.3 Encourage work-family/life balance	4	1.00	Provide a paid maternity leave, employment-protect paternity leave, and/or employment-protected parental leave.
	6.4 Job stability and retention	4	0.67	Maintain an employee turnover rate that is below the overall industry average for the preceding calendar year using statistics published by the Bureau of Labor Statistics (BLS) or equivalent agencies
	6.5 Performance feedback and appreciation	4	0.37	Have a formal performance feedback and appreciation program to help motivate employees and achieve improved performance
7.0 Community	None of the recommended strategies for this attribute is rated by the expert panel as highly or extremely influential on achieving construction workforce sustainability			
8.0 Maturity	8.1 Leadership and communication skills	5	0.74	Provide training opportunities to develop leadership and communication skills to full-time equivalent employees
	8.2 Accountability	4	0.74	Have a formal policy in place that sets clear expectations for all positions within the organizations including the quantity and quality of work expected from employees
	8.3 Develop competency	4	0.73	Sponsor or provide opportunities to obtain and maintain professional licensing and certification

Note: "M" stands for median, and "SD" stands for standard deviation.

Table 4: Respondent demographic information (n = 122)

Category	**Demography**	**% Response**	**N**
Job Title	Frontline supervisors (foremen and superintendents)	34%	42
	Frontline workers (carpenters, masons, electricians, etc.)	66%	80
	Total	100%	122
Organization Type	General Contractor	54.92%	67
	Sub-contractor	20.49%	25
	Owner Agency/ Client	9.02%	11
	Other (client rep, etc.)	15.58%	19
	Total	100%	122
Organization Location	International	6.56%	8
	National	10.66%	13
	Northeast	13.93%	17
	Southeast	25.41%	31
	Midwest	18.03%	22
	Southwest	11.48%	14
	West	13.93%	17
	Total	**100%**	**122**

Table 5: Ratings of workforce sustainability strategies by frontline employees

Attribute	Strategies	Mean	Median	Statistical Significance	Mean Normalization Score (MNS)
Nurturing	Productivity performance appraisals	3.95	4	< 0.01	0.72
	Professional training/development	4.07	4	< 0.01	0.83
	Onboarding process	3.65	4	< 0.01	0.45
Diversity	Diverse/inclusive work environment	3.77	4	< 0.01	0.55
	Diverse/inclusive frontline leadership	3.78	4	< 0.01	0.56
	Diverse/inclusive frontline employees	3.93	4	< 0.01	0.70
Equity	Non-discrimination policy	4.20	5	< 0.01	0.95
	Transparency	4.14	5	< 0.01	0.89
	Equitably pay across organization	4.20	5	< 0.01	0.95
Health & Wellbeing	Merit based recruitment/promotion	3.91	4	< 0.01	0.68
	Zero-injury goal	4.26	5	< 0.01	1.00
	Safety and health program	4.18	5	< 0.01	0.93
	Safety toolbox and meetings	4.14	4	< 0.01	0.89
Connectivity	Involve workers in decision making	3.89	4	< 0.01	0.66
	Regular meetings with supervisors	3.94	4	< 0.01	0.71
Value	Employee stock ownership program	3.16	3	0.37	0.00
	Health insurance and retirement plan	4.00	4	< 0.01	0.76
	Family resources	3.81	4	< 0.01	0.59
	Encourage work-family/life balance	3.95	4	< 0.01	0.72
	Job stability and retention	3.93	4	< 0.01	0.70
Maturity	Performance feedback/appreciation	4:00	4	< 0.01	0.76
	Leadership/communication skills	3.83	4	< 0.01	0.61
	Accountability	4.18	4	0.04	0.93
	Develop competency	3.88	4	< 0.01	0.65