



## TOWARDS DEEPER UNDERSTANDING OF FUTURE CRAFT SHORTAGES IN THE CONSTRUCTION INDUSTRY: SUPPLY AND DEMAND SIDES

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**Abstract:** Craft labor shortages are a recurring problem of the U.S. construction industry over the past several decades. The current work examines the supply and demand of craft labor across different trades to better understand the magnitude of craft labor shortages. The craft worker supply and demand is quantified based on the prediction of real demand from future industrial construction projects by using Construction Labor Market Analyzer (CLMA) data. The results of our analysis show that the workforce shortage affects specific trades (e.g. electricians, pipefitters, and welders) in specific U.S. geographic regions (e.g. the Southwest and Southeast). Understanding potential new inputs into the craft labor supply is examined through a survey to measure young people's attitude towards working in the construction industry. More than 440 completed questionnaires were collected from participants at the SkillsUSA 2016 national championship competitions across different trades. Most of the survey respondents were between the ages of 15-24, the age group that are potentially interested in a career in construction. The statistical analysis shows that young people across different trades perceive the construction industry in different ways especially in regards to factors such as job opportunities, challenges in the work-life balance, and learning opportunities. Another interesting result is that although the industry desperately needs welders, the future welders have a relatively pessimistic attitude towards working in the construction industry. The results of this study will help the construction industry to understand how young people across different trades view construction and what aspects should be emphasized to attract them to a construction craft career.

### 1 INTRODUCTION

Currently, the construction industry faces workforce shortages, mainly among highly skilled occupations because of two combined factors: 1) the high demand for construction projects; and 2) the low number of skilled craft workers (Komarnicki 2012, Glavin 2013, Wilder 2013, Shelar 2013). Vereen (2013) defined highly skilled occupations as requiring specialized education or training which take years to complete (i.e. carpenters, electricians, and pipefitters); and defined low skilled occupations as requiring minimal amount or no training and instruction (i.e. general helpers and roofers). Higher skilled occupations in construction are experiencing greater shortages in comparison to lower skilled occupations. After the Great Recession (2008 – 2009), electricians, pipefitters, welders, boilermakers, millwrights, and ironworkers were among the skilled crafts in the greatest demand among construction industry occupations in the U.S. (Wilder 2013, Shelar 2013, Gonzales 2013). All mentioned occupations are related more to the industrial projects. Further, Karimi et al. (2016) found that the shortages are already having a significant impact on project performance in the industrial construction sector.

On the other hand, the construction industry has traditionally been linked to poor images such as limited career permission opportunities, long working hours, shift work, and work overload (Djebarni 1996, Baldry 1997). Although, there are a lot of opportunities and positive aspects in construction industry, these poor images could be a major obstacle to attract new talents in the industry. Studies show that career-related decisions are made based on partial information and mainly perceptions of reality rather than reality itself (Hodkinson and Sparkes 1997, Foskett and Hemsley-Brown 1999). Therefore, we designed a survey to investigate how young people in different trades perceive working in the construction industry.

By comparing the results of both future demand for skilled workforce and perception of potential talents in different trades, we obtained a clearer picture of shortage problems across the industry. The results can help the industry to re-examine its recruiting strategies for young talents.

## **2 LITERATURE REVIEWS**

During the most recent economic downturn that began in 2008, the U.S. construction industry experienced immediate increases in unemployment because of the decrease in demand for construction projects (Fridley 2013). However, estimates indicate that the U.S. construction industry will be the fastest growing industry over the next decade, which will create an estimated 1.6 million jobs after the economic recovery (Glavin 2013; Gonzales 2013). However, in periods of high regional construction volume, hiring and retaining skilled craft workers is challenging because companies must compete for a relatively limited craft labor pool that shrank in the period of unemployment in the preceding recessions as unemployed craft workers sought jobs in other industries (FMI 2013).

Due to this high demand for construction, companies are losing money due to the lack of skilled craft workers. According to the Associated General Contractor (AGC), 79% of construction companies in the U.S. are having difficulties finding qualified workers to fill job openings (AGC 2015), especially in the Gulf Coast region (Wilder 2013).

Looking into the future, a study by Vereen (2013) forecasted the craft demand for skilled construction labor in the U.S. considering multiple factors (labor demand, interest rate, material prices, construction output, productivity, and real wages). Vereen (2013) used monthly data between 1990 and 2011 from multiple datasets. Moreover, she applied the Vector Auto Regression (VAR) model for the forecasting and found that a range between 5.3 and 6.3 million skilled workers will be in demand by 2022, which means the current skilled workforce needs to increase by 1.3 to 3 million workers by 2022. Furthermore, this also means 145,000 to 330,000 new workers need to be added annually to meet the demand. This result did not take into account the retirement of the Baby Boomers, though, which will make the demand for workers even higher.

To attract more skilled workforce, the industry needs to understand how upcoming workforce perceives the construction industry. According to the theory of planned behavior (Ajzen, 1991), to predict an individual's behavior, we need to understand the underlying factors of intention or motivation. Attitude is one of the most important determinants of intention. Attitude indicates how favorable or unfavorable an individual's evaluation is regarding a behavior (Ajzen 1991). Attitude is an important factor in an individual's evaluation of a job and several studies have shown that ideas, perceptions, stereotypical occupational images are critical factors in career-related decisions (Hodkinson and Sparkes 1997, Foskett and Hemsley-Brown 1999).

This approach has been applied in several studies to describe career-related decisions (Gelderens et al. 2008, Zellweger et al. 2011, Chen et al. 2016).

## **3 RESEARCH METHOD**

To study the demand of the construction craft workers, the authors applied Construction Labor Market Analyzer (CLMA) data source. CLMA is "an online application that helps owners, contractors, labor providers and the construction industry to understand the skilled labor market and manage project labor

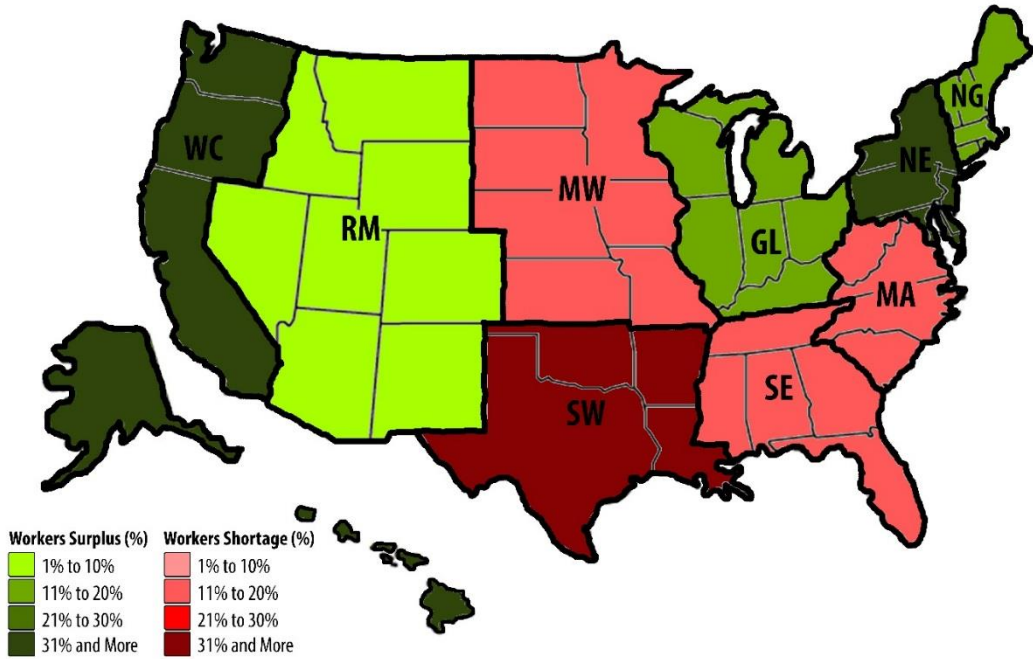
risk.” CLMA has information of more than 4 million projects with a value of \$ 4.2 trillion. All of the industrial projects in the CLMA are actual projects, which were either provided directly by the owner or were initiated and managed by the CLMA analysts. For Non-Industrial Information, CLMA analysts use the entire McGraw Hill Dodge (Dodge Analytics) portfolio. CLMA analysts transfer these future projects into estimated number of workers in a particular trade and in a specific region. However, the Bureau of Labor Statistics (BLS) provides estimates of the number of people in a particular trade and in a specific region (the number includes industrial and non-industrial workers). The authors use the BLS number as an estimated supply and CLMA number as an estimated demand. Based on Industrial Info Resources (IIR) regions’ borders, the authors divided the US map into nine regions [West Coast (WC) including HI and AK states, Rocky Mountains (RM), Mid-West (MW), South West (SW), South East (SE), Great Lakes (GL), Mid-Atlantic (MA), North East (NE), and New England (NG)]. This division of regions allows us to include the effect of workers’ movements.

To study the young people’s attitude towards working in the construction industry, the survey method was used. Factors of attitude were identified based on a thorough literature review and the discussion within our research team, which included industry experts involved with workforce development in construction. The survey and research framework were reviewed and approved by the university internal review board (IRB). After conducting a pilot test and receiving feedback, the final version of the questionnaire was developed. Most of the survey respondents were between the ages of 15 and 24 who attend the SkillsUSA 2016 national championship competitions across different trades. The data were collected from participants who attended construction related competitions including carpentry, electrical construction wiring, masonry, and welding. We also collected data from participants in non-construction related competitions including marine equipment technology, aviation maintenance technology, diesel equipment technology, automotive service technology and architectural drafting. Since people in non-construction trades have required skills that can be applied in the construction industry, they were included in the sample. We put people in the architectural drafting in a separate group. The statistical analysis results showed that they evaluated the construction craft careers differently. This might be due to the nature of architectural drafting which is close to engineering career. Subjects in non-construction trades and architectural drafting include 25% of our sample. A total of 440 completed questionnaires were collected from participants. The survey gathered information on demographic background, intention to choose to work in the construction industry, and potential factors that influence attitude towards the construction industry. Participants were asked to evaluate the degree to which they agree or disagree with statements related to different aspects of working in the construction industry using a 7-point Likert-type scale. The jobs included in this study were limited only to the construction trades such as carpenters, electricians, pipefitters, and welders.

## **4 RESULTS**

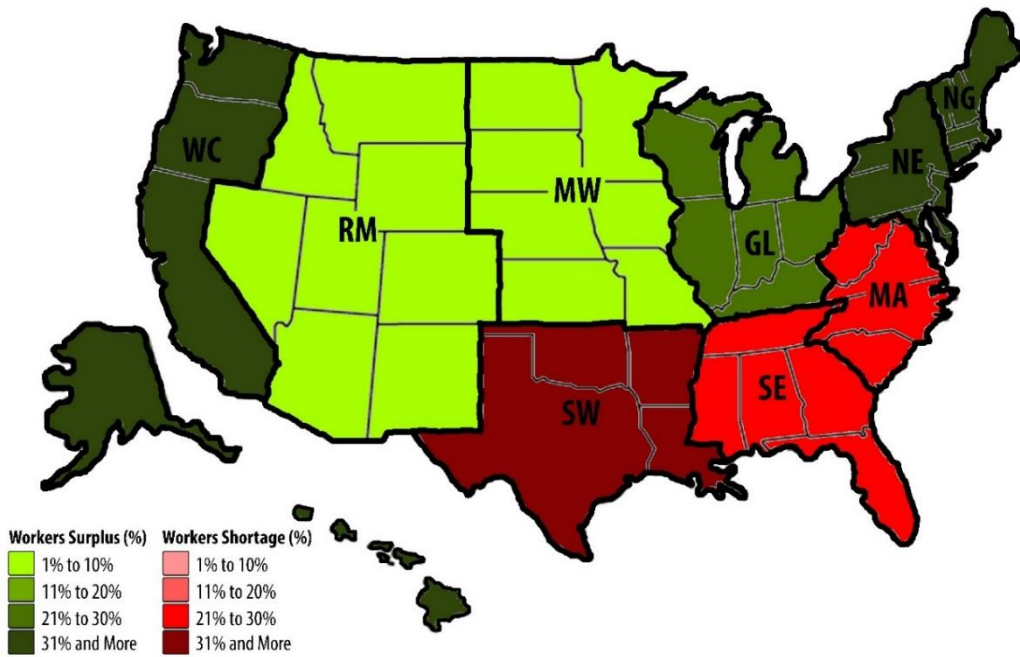
### **4.1 Labor Demand**

Using Construction Labor Market Analyzer (CLMA) data, the authors found that the demand of the craft workers varies by region and by trade. The results contain the construction industry’s workers head count regionally in quarter basis for future decade in the U.S. The authors focused only on electricians, pipefitters, and welders since these trades are on high demand currently. The most demanding period for electricians (Figure 1), pipefitters (Figure 2), and welders (Figure 3) is from quarter 1, 2018 to quarter 3, 2018. Green colors represent surplus of workers, and red colors represent shortages. For electricians and pipefitters, the most demanding region is Southwest that will need in 2018 more than 30% of current workers. For Welders, the demand is affecting all the U.S. and some regions need more than 5 times of current workers like the Southeast.



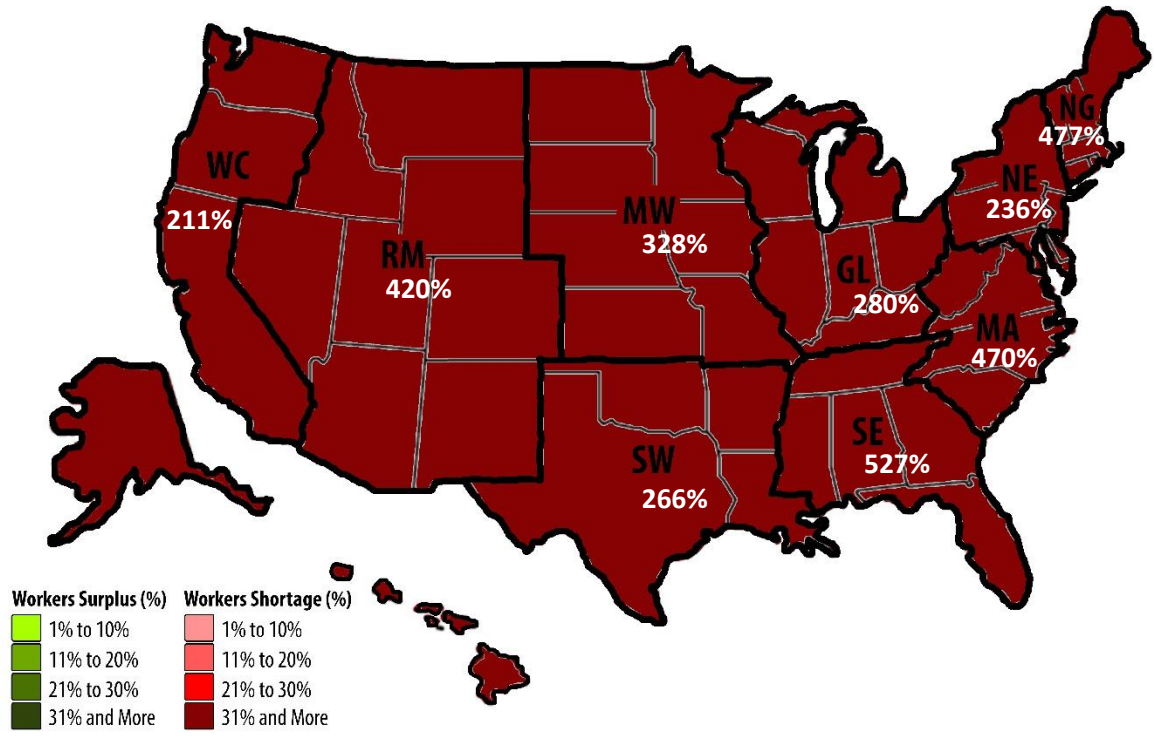
SOURCE FOR ESTIMATED LABOR DEMAND: Construction Labor Market Analyzer (CLMA)

Figure 1: Future labor demand [Electricians] – Quarter 3, 2018



SOURCE FOR ESTIMATED LABOR DEMAND: Construction Labor Market Analyzer (CLMA)

Figure 2: Future labor demand [Pipefitters] – Quarter 3, 2018



SOURCE FOR ESTIMATED LABOR DEMAND: Construction Labor Market Analyzer (CLMA)

Figure 3: Future labor demand [Welders] – Quarter 3, 2018

**4.2 Labor Supply**

Our sample includes 92% males and 6% females (two percent did not identify their gender). Twenty-five percent of the respondents are between 15 to 17 years old and 61% are between 18 to 24 years old, and the remaining 14% are older than 24 years old. In terms of ethnicity, distribution of respondents is 81% White/Caucasian, 10% Hispanic/Latino, 3% African American, and 5% other ethnic groups. Most of the people in our sample (89%) reported that they took career and technical education classes or courses related to either construction or other industries (such as automotive, aviation, hospitality or health) in their high school. Figure 4 shows the distribution of respondents based on work experience in any construction-related jobs.

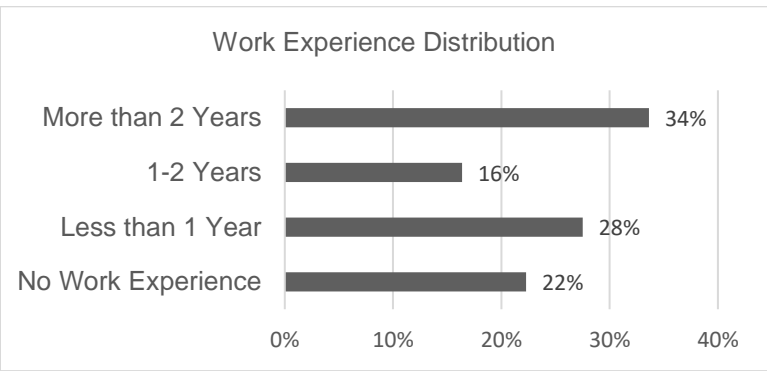
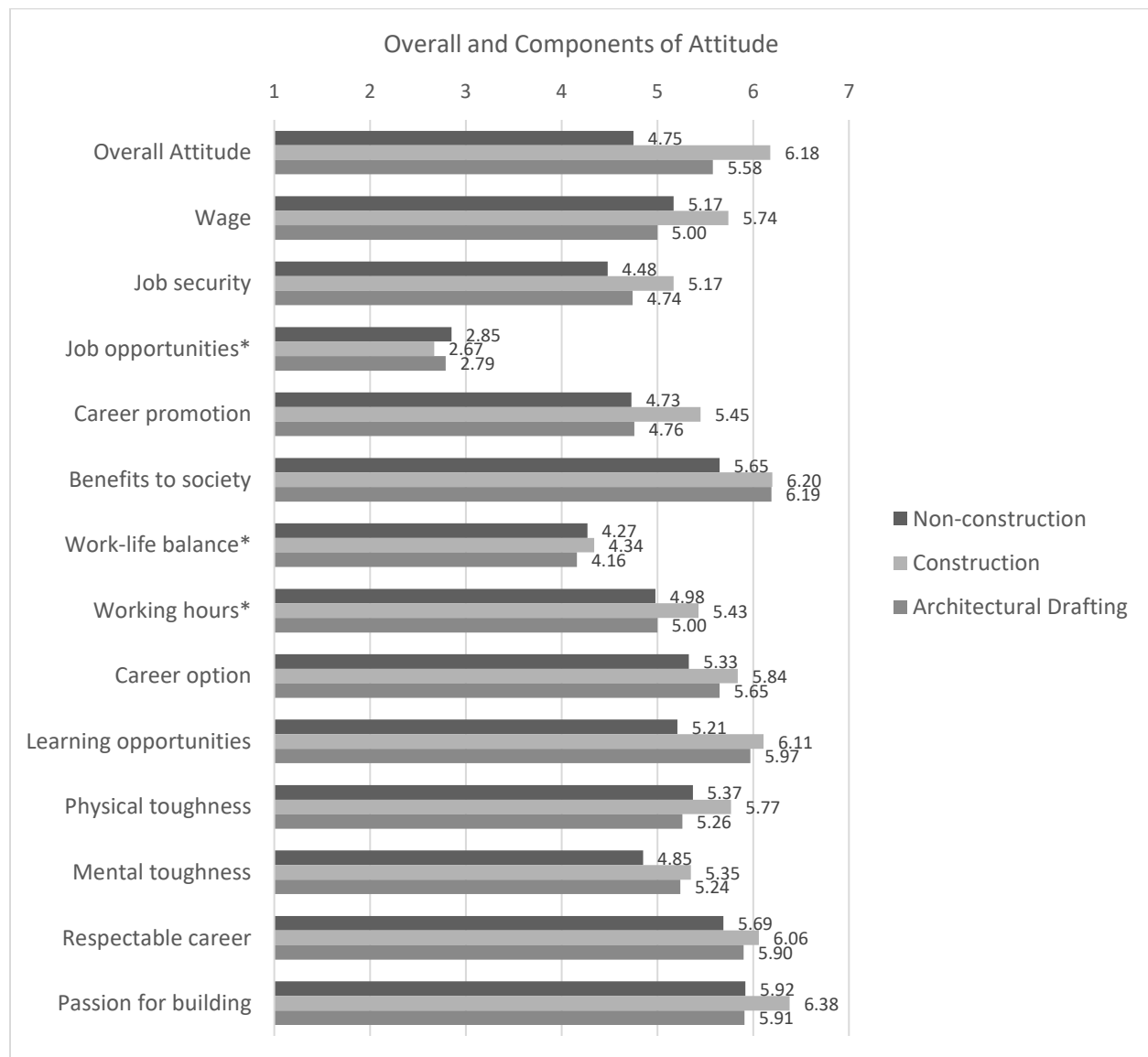


Figure 4: Distribution of respondents based on work experience

Respondents were asked to indicate how much likely is to choose a career in the construction industry (Intention). Also they were asked to evaluate the degree to which they believe that choosing a career in the construction industry seems like a good idea to them. By this, we measured the overall attitude towards working in the construction industry. The Pearson correlation between intention and overall attitude in our sample is 0.859 (sig. level = 0.000) which indicates that there is a strong relationship between attitude and intention.

In addition, components of attitude were measured. These components are mentioned in Figure 5. These components along with the overall attitude were compared in construction-related, non-construction-related trades and architectural drafting group. Statistical analysis confirmed that people in non-construction-related trades and architectural drafting group have significantly lower attitude towards working in the construction industry (sig. level = 0.000). People in construction trades evaluated different aspects of working in construction more positive than people in non-construction related trades and architectural drafting group did.



\* Negative questions

Figure 5: Distribution of respondents based on work experience

More interestingly, we compared the components of attitude within construction-related trades. Across carpentry, electrical construction wiring, masonry, and welding, we found that people in welding have a relatively pessimistic attitude towards working in the construction industry. Surprisingly, welders believe that job opportunities in the industry are not as promising as other trades think (sig. level= 0.000). In addition, they do not see a high chance of career promotion compared to other trades (sig. level= 0.003). For electricians, it is more challenging to balance work and family responsibilities than other trades (sig. level= 0.005). Welders relatively see limited career options and learning opportunities in the industry (sig. level= 0.003 and sig. level= 0.000).

Moreover, the passion and inherent interest in building things and work with hands were relatively the same across people in different trades except welders, who reported they are less passionate to build things (sig. level= 0.029).

Meanwhile the industry needs more welders in future, it seems welders are more concerned about the long-term issues including promotion, career options, and learning opportunities.

## 5 CONCLUSION

In this research by analysis of the supply side, we demonstrated that 30% more electricians and pipefitters will be needed in the Southwest region to meet the expected work demand in 2018. Southeast, Mid-Atlantic, and Midwest are the next most severe regions.

Moreover, twice as many welders will be needed in 2018 than is currently available. This demand is affecting all the U.S. and the most affected region is Southeast that needs more than 5 times the current number of welders. Mid-Atlantic, New England, and Rocky Mountains are the next most severe regions that need approximately 4 times the current number of welders.

On the other hand, the analysis of perception of young people between the ages of 15 and 24 years who were exposed to vocational and career technical education, implied that potential welders in future have relatively pessimistic view towards working in the construction industry. The results indicated that they are more concerned about the long-term issues including promotion, career options, and learning opportunities compared to people in other trades we investigated in this study.

Also young individuals in non-construction trades who have the adequate skills to work in the industry, evaluated different aspects of working in construction lower than people in construction trades. The results of this research can shed more light on how the construction industry should change its recruiting strategies to guarantee the attraction of new individuals into the industry.

## 6 ACKNOWLEDGEMENT

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