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Towards a Deeper Understanding of the U.S. Workforce Development System in the Construction Industry

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TOWARDS A DEEPER UNDERSTANDING OF THE U.S. WORKFORCE DEVELOPMENT SYSTEM IN THE CONSTRUCTION INDUSTRY

by

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The final copy of this thesis has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

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Abstract

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Title: Towards a Deeper Understanding of the U.S. Workforce Development System in the Construction Industry

Thesis directed by Professor Paul Goodrum

Abstract:

The construction industry currently faces several challenges in areas of workforce development that can hamper its sustainability and growth. Several studies have documented shortage of skilled craft workers in construction. Most construction firms in 2017 reported that growing workforce shortages in construction have made it difficult to find qualified workers. They expected the workforce shortage would continue to be a challenge in the near future. The shortage has worsened to the point that it is not only hard to find quality craft workers, but it is affecting projects' schedule, cost, and safety. Part of this problem is because younger people are not so much eager to enter the industry and work in technical occupations. Moreover, some skilled workers exit the industry. It seems that the workforce development system, which is responsible for training, recruitment, and retention of skilled workforce, does not fully address the industry demand. This study, I try to shed light on workforce development system from both micro and macro perspective.

From a micro perspective, it focuses on the career decision-making process of both the future and the current workforce. Using Theory of Planned Behavior, I want to understand what factors influencing young people to choose a career as craft workers in construction. For the current workforce, I am interested to determine the motivational factors influencing people decision to stay in the industry and quantify their relative strengths. The results of this study can help construction firms to improve their recruitment and retention policies and practices.

From macro perspective, a panel of industry experts involved with workforce development helped the research team to investigate strengths and weaknesses of the system. Intensive literature review and archival data analysis helped to gain more in-depth understanding of the situation. Through several panel discussions and using Analytical Hierarchy Process methodology, I identified and prioritized potential policies to overcome the challenges. The policies recommended by this research could outline the major steps to initiate the path to make the U.S. workforce development system a global example.

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1 INTRODUCTION

1.1 BACKGROUND AND MOTIVATION

The construction industry currently faces several challenges in areas of workforce development that can hamper its sustainability and growth. Over the past decades, several studies have documented shortage of skilled craft workers in construction (Business Round Table 1997, Construction Users Round Table 2001, McGraw-Hill Construction 2012, Construction Industry Institute 2015). More recently, the Associated General Contractors of America's (AGC) survey in 2017 reported that growing workforce shortages in construction have made it difficult to find qualified workers. Most construction companies expected the workforce shortage would continue to be a challenge in the near future. Some studies also found that the shortage has worsened to the level that it is not only hard to find qualified craft workers, but also negatively impacting projects' schedule, cost, and safety (Karimi et al. 2016, 2017, 2018).

The average age of craft professionals within the industry in increasing and the rate of this increase is four times the national average for all other industries (Construction Industry Institute 2015). Part of this problem is because technical occupations in the industry are seemingly not attractive to younger generation (McGraw-Hill Construction 2012). Furthermore, Generation Z (born 1990-99) are gradually entering the labor market. Some believe that they would bring new challenges to the human resource management in companies (Tulgan 2013). It is likely that if the construction industry does not understand the needs and wants of this new generation, the labor shortage may become even worse.

The U.S construction industry's challenge to find enough qualified craft workers reflects a widespread challenge that all other industries relying on CTE-based workforce have. As an example, it is estimated as many as 2 million future jobs in manufacturing sector in U.S. could become unfilled from the lack of workers with the right skills and knowledge (Giffi et al. 2015). Movement of experienced workers, a negative image of the manufacturing industry among younger generations, lack of STEM (science, technology, engineering and mathematics) skills among workers and a gradual decline of technical

education programs in public high schools are identified as main sources for this skill gap in manufacturing (Giffi et al. 2015).

Despite of critical role of Career and Technical Education (CTE) in helping many youth understand the career path of working in industries like construction, the opportunities for high school students to take a CTE course has greatly diminished with more resources being allocated to college preparation based courses (Construction Industry Institute 2015). It seems the common assumption in the U.S. is that the only way to become successful is to acquire a 4-year college degree (Gray & Herr 2006). Based on this assumption, most policies encourage the pursuit of a 4-year college degree. Although, there is no doubt that all individuals need postsecondary education, there are other forms of postsecondary education that might suit young people needs and wants.

As a system, the role of workforce development is to the recruit, train, employ and retain individuals in valuable employment opportunities. It is also in a dynamic relationship with other society subsystems such as economy (Hodge 2007). However, evidences mentioned above show that there is misfit between the workforce development system and the U.S. economy.

Worsening workforce shortage in construction makes motivational factors crucial to keep the current workforce in the industry. However, there is limited research that formally applies motivation theories to the construction industry. More importantly, previous studies have shown that there are differences between what employers think as their employees' motivational factors and what employees want from their jobs (Dessler 2013). This incomplete understanding of employees' motivational factors can result in ineffective human resource practices to keep employees motivated.

Nowadays, diversity in the workplace is among the main challenges in managing people (Noe et al. 2011, Dessler 2013). Despite the challenges to human resource management, many US companies have acknowledged and utilized the diversity of labor force to benefit from its talents and skills and gain competitive advantage in their businesses (Noe et al. 2011). New approaches in human resource

management require companies to proactively segment their employees and provide customized human resource policies according to their needs (Dessler 2013). To adopt a segmentation approach, construction companies should understand the needs and desires of different segments of their employees.

In addition, motivational factors may vary across different people. To benefit from various talents and skills, the industry needs to understand the difference in the motivational drivers of its diverse workforce. Gender diversity is one of the important factors that needs careful examination. The percentage of women in construction trades has remained almost the same from 1983 to 2010 (National Women's Law Center, 2012). This creates a major contrast between jobs in the construction industry and other industries regarding gender diversification. In fact, the percentage of women in many occupations outside of construction that used to be more male-dominated have increased during the same time (i.e., 1983 to 2010). Although some studies have focused on examining motivational factors among craftswomen in construction (Dabke, et al. 2008, Wangle 2009), I find no specific study to investigate differences between males and females' attitude towards working in construction. Since attracting female talents to the industry can be one of the remedies to workforce shortage facing the industry (Schleifer 2002), understanding the differences between males and females attitude is the key to customizing human resource practices in the construction companies.

In addition to gender diversity, differences in wants and needs of different generations bring new challenges to human resource management. As an example, a recent study on 1,700 US workers conducted by Gallup (2016) showed that different generations expected different things from their jobs. The study specifically examined the expectations of millennial workers or Generation Y (Born 1977 to 1995). According to this study, the two factors of: learning and growth opportunities and managerial quality are the most important factors they look for in their job search (Gallup 2016). Likewise, the analysis of attitude across craft workers from different generations allows construction companies to design more customized policies.

To thoroughly examine the current challenges facing the workforce development system, the system needs to examined from both a micro and macro perspective.

1.2 STATEMENT OF THE PROBLEM

From a micro perspective, this research focuses on the career decision-making process of both future workforce (between 15 and 24 years old) and current workforce (above 24 years old). We want to understand what factors influencing young people to choose a career as craft workers in construction. For the current workforce, I am interested to determine the motivational factors influencing people decision to stay in the industry and quantify their relative strengths. I also want to understand if there are differences in their attitude based on gender and generation as the two main sources of diversity among craft workers.

From macro perspective, the main goal of this research is to investigate the U.S. workforce development system and try to understand what factors contribute to the outputs of the system. This understanding helps us to recommend policies that can renew the U.S. workforce development system and overcome the current challenges.

For the purposes of this research, the workforce development system includes elements of the U.S primary, secondary, and post-secondary education system, construction training, and placement and retention efforts of craft professionals.

Although, any effort to meaningfully change the system will require all stakeholders to work together, I am hopeful that the results of this research could outline the major steps to initiate the path to make the U.S. workforce development system a global example.

1.3 DISSERTATION OUTLINE AND RESEARCH QUESTIONS

This dissertation was organized in a four-paper format. The title of each paper and the research questions addressed in each of them are as follow:

Paper 1: What Motivates Young Talents to Pursue Craft Careers in Construction?

Research questions:

1. How do different demographic groups (based on gender, race, age, and work experience) perceive working in the construction industry?
2. How does the support/lack of support of others (e.g. family, spouse/partner, friends, schoolteacher, and school consular) influence the individual's decision to choose a career in the construction industry?
3. How does the individual's perception of the difficulty of entering into the construction industry influence her/his decision to choose a career in construction?

Paper 2: Factors Influencing Craft Workers' Motivation to Pursue Careers in the Construction Industry

Research questions:

1. How does the current workforce perceive working in the construction industry? Is there any difference in their perception based on gender and generation?
2. How does the social support influence the individual's motivation to stay in a career in the construction industry?
3. How does individuals' self-assessment of their ability to become successful in construction influence their decision to stay a career in construction?

Paper 3: Career Selection Model for Constriction Craft Workers: Application of the Theory of Planned Behavior

Research questions:

1. How well does Theory of Planned Behavior explain the career decision-making model for the future and current workforce in construction?
2. In what ways is the career decision-making model of the future workforce different from the model for current workforce?

Paper 4: Investigating Policies to Improve the U.S. Workforce Development System

Research questions:

1. What are deficiencies and strengths of the current U.S. workforce development system?
2. How does the construction industry stakeholders and workforce participants influence workforce development outcomes?
3. What policies should be adopted to transform the current system into an effective workforce development system that will serve both the needs of the construction industry and the U.S. economy as a whole?

Moreover, in table 1, I illustrate how much different parts of my dissertation are relevant to three main elements of the workforce development system.

Table 1: The Relationship between Different Sections of Dissertation to the Workforce Development System

Sections	Workforce Development System Elements		
	Training	Placement	Retention
Paper 1	**	***	*
Paper 2	**	**	***
Paper 3	**	***	***
Paper 4	***	**	*

*Note: *** highly relevant, **: moderately relevant, and *: slightly relevant.*

1.4 OVERVIEW OF THE RESEARCH METHOD

As mentioned earlier, the main objectives of this research include 1) analyzing the current U.S. workforce development system from both a micro and macro perspective, and 2) recommending policies to help design an effective workforce development system.

In order to understand the current U.S. workforce development system, I attempt to study the system from both a micro and macro perspective. From a micro perspective, survey methodology was employed to understand how people make decisions to choose or continue a career in the construction

industry. The survey targeted both young adults who are at the age of career selection and current craft workers. The results help to understand and compare the motivational factors behind career selection of the future and the current workforce. From a macro perspective, literature review, archival data analysis, discussion panels, and case studies helped the research team to gain in-depth understanding of the system.

The results of the previous phases enabled the research team to achieve a better understanding of the U.S. workforce development system and its strengths and weaknesses. Several discussion meetings held between the experts in our research team along with literature review helped the team to develop ideas for policy recommendations. The Analytical Hierarchy Process (AHP) as a rigorous scientific approach was applied to evaluate and prioritize the final policy recommendations.

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2 WHAT MOTIVATES YOUNG TALENTS TO PURSUE CRAFT CAREERS IN CONSTRUCTION? : THE THEORY OF PLANNED BEHAVIOR

2.1 ABSTRACT

Past studies indicate that the U.S. construction industry is facing a skilled labor shortage. Increase in the average age of craft workers within the industry, change in workforce demographics, decline in career and technical education in North America, and the difference between motivational factors of new entrants and the current workforce are evidences suggesting that the industry is facing long-term structural changes regarding the construction craft workforce. These changes demonstrate the need for understanding the underlying factors that influence career selection of the next generation of craft workers in construction. To develop this understanding, a survey was designed based on the Theory of Planned Behavior to measure 1) individual's attitude, 2) subjective norm, and 3) perceived behavioral control. The survey was distributed nationally, and 778 completed questionnaires were received. The target population for the survey was individuals between the ages of 15-24 who were exposed to Career Technical Education (CTE) or participated in construction training programs. The main contribution of this research to the body of knowledge is the identification of the factors influencing young people to choose a career as craft workers in construction. The statistical analysis shows that if young people have some work experience in construction-related jobs, it can significantly improve their intention to choose a career in the construction industry. In addition, I created a multivariate regression model to understand the relative importance of components of attitude towards working in construction. I find that there are differences in components of attitude across several demographics. Another major finding is that self-confidence is highly correlated with intention. Based on the results of this study, I make several recommendations to the construction industry on how to attract the next generation of craft workers.

2.2 INTRODUCTION

The U.S. construction industry faces a long-term structural change in workforce demographics. The rate of craft workers leaving the industry is greater than the rate it is attracting them, especially in high skilled trades such as electrician, pipefitter, and welder (Albattah et al. 2015). This poses severe challenges to the construction industry as projects facing workforce shortages experience cost and schedule overruns, and have to deal with increased safety incidents (Karimi et al. 2016, 2017).

One contributing factor to this change is that younger workers are not so eager to enter the industry. McGraw-Hill Construction (2012) reported that 62% of trade firms that participated in its survey believed that their trades were not attractive to the younger generation. Moreover, Generation Z (born 1990-99) are gradually entering the labor market. Some predicted that they would bring profound challenges to all businesses due to their unique characteristics (Tulgan 2013). It is likely that if the construction industry does not understand the needs and wants of the new generation, the labor shortage may become even worse. The contribution of the current work to the body of knowledge is to identify the underlying factors influencing young people's choice of a career as a craft worker in construction. The relative importance of components of attitude and differences across several demographics are also examined. The jobs included in this study are limited only to the construction trades such as carpenter, electrician, ironworker, painter, pipefitter, and welder.

There are several career development theories that describe how individuals make decisions about the type of occupation they want to prepare for and engage in. These theories fall into two categories. Theories in the first category assume that career decision making is a rational process. According to these theories, individuals are highly rational and make career decisions by gathering all the relevant information and evaluating all related alternatives (Herr et al. 2004). Theories in the second category, on the other hand, challenge the rationality assumption. Due to the biased and limited availability of information and the number of factors that need to be considered, these theories suggest that people cannot follow a completely

rational process in decision making about their career (Hodkinson and Sparkes 1997, Herr et al. 2004). In this research, I adopted the second approach.

Using a survey methodology designed based on the theory of planned behavior, this study investigates the perception of young people towards working in the construction industry. The theory of planned behavior is a psychological theory that links perceptions and beliefs with behavior (Ajzen 1991). Since career-related decisions are made based on the perceptions of reality rather than the reality itself (Foskett and Hemsley-Brown 1999), I used the theory of planned behavior to understand the underlying motives behind people's decision to select a long-term career as a craft worker in the construction industry. Poor images such as limited career progression opportunities, long working hours, shift work, and work overload have traditionally been associated with the construction industry (Djerbarni 1996, Baldry 1997). In order to attract young talents, the industry needs to understand how the upcoming workforce perceives working in construction.

Moreover, the role of social interaction has been emphasized in previous studies (Hodkinson and Sparkes 1997, Kniveton 2004, Bright et al. 2005, Taylor 2005, Zafar 2011, Granitz et al. 2014). Young individuals highly rely on information gathered from family members and peer friends (Taylor 2005, Zafar 2011, Granitz et al. 2014). Family members and peer friends who work in an occupation can also give young people confidence that they can be successful in that occupation (Taylor 2005).

The self-assessment of abilities to achieve a goal is also a vital factor that determines how individuals approach a goal (Bandura 1977). From this perspective, self-efficacy or confidence can be a strong predictor of career decisions (Hacket and Betz 1995).

By including perception, social influence and mental barriers, the theory of planned behavior provides a thorough theoretical framework to consider different aspects of career-related decisions (Ajzen 1991). I applied this theory to examine what factors might influence young people's decision to choose a

career in the construction industry given their demographics. The results can help industry re-evaluate its recruiting strategies for young talents.

2.3 LITERATURE REVIEW

2.3.1 Career Decision Making Process

Career decision making is one of the most important decisions for every young person, because it affects his/her future work and life (Gati & Asher 2001). Previous studies have shown that young adults start evaluating their career choices early in high school (Gysbers 2008, Granitz et al. 2014). There are different approaches to describe how people make decisions about their careers. As was previously mentioned, the theories in this area fall into two main categories. Theories in the first category have a highly rational approach to career decision making while the theories in the second category challenge the assumptions of rationality.

Among the theories in the first category (i.e., rationality category), the theory developed by Parsons in the early twentieth can be mentioned. This theory explains career decision-making based on matching a person's abilities and interests with characteristics of the work environment and the labor market (Parsons 1909). This approach was later extended by John Holland's personality–job fit theory. He presented six personality types and suggested that young adults need to clearly identify their personality traits in order to make their best career decision. In addition to the individual's characteristics, the characteristics and requirements of different careers should be considered. The satisfaction and tendency to leave a job is determined by how well the person matches his or her personality traits to the job (Holland 1997).

As another theory in the first category, Gati and Asher (2001) recommend a more practical 3-stage model for career decision-making process, with three steps of Prescreening, In-depth exploration, and Choice (PIC), for career decision-making process. The prescreening step involves identifying potentially relevant career alternatives based on the individual's preferences. The in-depth exploration step is to explore the promising alternatives including examination of individual's own suitability to the job as well as the

ability to comply with the requirements of the role such as required education and physical strength. Finally, the choice step is to choose the most suitable alternative, based on a comparison between the available alternatives.

Both the personality–job fit theory and the PIC model suggest a completely rational process for career decision making. However, this approach was challenged by other theorists in the second category. Hodkinson and Sparkes (1997) believed that career decision making is not a rational process as traditional vocational psychology described. They discussed that although young people are able to decide rationally regarding their careers, they have to pragmatically make decisions based on the partial information that is available to them. To describe this process, Hodkinson and Sparkes use the term "pragmatic rationality". From this view, career decision is highly influenced by contextual factors such as interaction with other people, experiences, family influences, information derived from media, stereotypical occupational images portrayed in film and entertainment, and emotional propensity (Hodkinson and Sparkes 1997). In reality, it seems that career-related decisions are made based on ideas, perceptions, and images that begin to form from early childhood. In this process, perceptions of reality, rather than reality itself, are critical to the decision (Foskett and Hemsley-Brown 1999).

Social learning theory of career development tries to describe career decision making from a learning perspective. This theory was developed based on social learning theory of Albert Bandura (Mitchell 1996). Bandura (1977) criticized the idea of the conditioning approach as a dominant mode of learning in human beings. Conditioning or instrumental learning occurs when an individual is positively reinforced or punished in response to certain behaviors. In contrast, Bandura emphasized observational learning,which occurs by observing other people's actions and the consequences for them (Bandura 1977). Mitchell (1996) believed that four main factors influence the individual's career decision making: 1) genetic endowment and special abilities, which are inherent qualities that may set limits to attain certain skills and opportunities, 2) environmental conditions and events, which include factors such as social, cultural, political, and economic forces, 3) learning experiences, which are unique individual's instrumental and

observational learning experiences, and 4) task approach skills, which include performance standards, work habits, cognitive processes, mental sets, and emotional responses.

Gottfredson's Theory of Circumscription, Compromise and Self-Creation (2002) attempts to describe how career choice develops in young individuals as self-concept develops with age. According to Gottfredson, the first process is circumscription in which the child gradually becomes aware of size and power, sex roles, social values, and internal and unique self. This understanding is shaped through the socialization process from the stimuli surrounding the child. Through this process, the child excludes unacceptable occupations based on her perceived fit with the developing self-concept. So, as the child becomes six to eight years old, even before getting old enough to rationally evaluate occupations, the child has learned what is considered appropriate for him/her. In the next step, individuals are forced to compromise their career choices from the remaining alternatives. Young people evaluate career choices based on their perception of jobs according to gender (masculine/feminine), level of prestige, and area of work (Gottfredson 2002).

Gender schema theory explains how gender identity is formed within a child by information obtained from family, friends, school, the media, and engagement with everyday life. People use their gender schema throughout the rest of their lives to process information about appropriate behaviors and attitudes including career decisions and preferences (Bem 1981). For example, a study showed that males put more emphasis on income levels, and females put more emphasis on relationship with others when choosing a career (Gati et al.1995). In another study among UK students of 14 to16 years of age, researchers found that gender strongly defines how jobs are perceived and evaluated, and how job choices are made (Millward et al. 2006).

Several studies showed that young people are highly influenced by the information they receive from family, friends, teachers and career counsellors (Kniveton 2004, Bright et al. 2005, Taylor 2005, Zafar 2011, Granitz et al. 2014), but they do not have the same influence on the decision. Parents and family

members are the most important influencers in the career decision (Taylor 2005, Zafar 2011, Granitz et al. 2014), but their influence changes over time (Cabrera and La Nasa 2000). For example, some studies found that college students become less dependent on information they receive from their families when they learn more about the majors through courses, work experience, and other sources of information (Arcidiacono 2004, Zafar 2011). The social influence does not merely play a role in the information gathering process. Taylor (2005) discussed that for most youth, especially those who choose vocational and technical education and related career paths, career decisions involve uncertainty, anxiety, stress and confusion. Family members or peer friends who already work in an occupation not only can give young people very clear and personalized information about the job but also can make them more confident that they can be successful in that occupation.

Bandura's (1977) self-efficacy theory explains that a person's perception of her abilities to becoming successful in a certain situation or achieve a goal has a significant role in the way she/he deals with the situation or approaches the goal. Hacket and Betz (1995) extended this approach to career selection decisions. As an example, Hacket (1985) described how higher levels of self-efficacy can lead to "approach" rather than "avoidance" behavior towards major selection among college students. She argued that self-efficacy or confidence not only reflects the ability information but also significantly predicts career choice behavior.

2.3.2 Working in Construction as a Career Path

As discussed in the previous section, the individual's perception towards a specific job plays a significant role in career decision making. Meanwhile, many studies find that the construction industry needs to improve its image to attract young talents to the industry (Gale 1994, Schleifer 2002, Dainty and Edwards 2003, Ling and Ho 2013, Ball 2014, Yng Ling et al. 2015). Studies have showed that people outside of the industry perceive jobs in the construction industry as dangerous, dirty, stressful, physically intensive and male dominated (Polachek 1981, Barthorpe et al. 2000, Ling and Ho 2013, Yng Ling et al. 2015). They also believe that working in the construction industry demands long working hours and is not

supportive of a work-life balance (Djerbarni 1996, Francis et al. 2009, Ling and Ho 2013). Some mentioned low professionalism among workers, lack of autonomy and low job securities as other negative aspects of the industry (Ling and Ho 2013, Yng Ling et al. 2015).

Gender stereotypes have also played a significant role in individual's decision to choose a career in the construction industry. Usually, trade roles are interesting to males (Polachek 1981, Barthorpe et al. 2000). In a more recent study, Teig and Susskind (2008) conducted a series of experiment with children aged 6-12 years old in the US to understand the relationship between gender and perceptions of different occupations. Children in the experiments viewed people in the construction related jobs such as a construction worker, plumber, truck driver, building contractor and electrician as highly masculine. In another study among UK students of 14 to16 years old, Millward et al. (2006) found that girls are more likely to consider plumbing, mechanics and building as messy, dirty and masculine. The researchers believed that the participants in the study did not appear to have much knowledge about the reality of the jobs, but they viewed and evaluated the jobs strongly based on gender stereotypes. As an example, girls highly emphasized the importance of relationships and a sociable approach to life. Nevertheless, they disregarded the fact that plumbing is a job in which one meets new people on a daily basis; visits new places and can have good social relationships (Millward et al. 2006).

Many construction trades are categorized as technical occupations. Meanwhile, many parents, teachers and high school counselors do not consider these kind of occupations as an acceptable career path for their children (Schleifer 2002, Gray and Herr 2006). Gray and Herr (2006) discussed that parents and school systems in the US increasingly encourage students to pursue a 4-year college degree as an only acceptable career path, regardless of their interests and academic achievement.

Francis et al. (2014) found that career counsellors in Australia exhibited a gender bias in directing students to consider a career in construction. Counselors directed young men more frequently into construction than young women. However, counsellors with more experience in their role, a higher

knowledge of construction careers and personally knowing someone in construction were more likely to direct young women to the industry (Francis et al. 2014). Comments from some participants indicated that they believe the construction industry was sexist, reluctant to employ females, and therefore, it was difficult for females to succeed in this culture.

Taylor (2005) conducted a research among Australian youths who entered the building trades to understand their career decision-making process. The results indicated that the career-related decisions were influenced by images of masculinity and aspirations for an on-the-job lifestyle. For many of the participants in the research, the job lifestyle and the image of work environment had been formed over time and long before they participated in the vocational education and training programs. Observation of a person in a trade provided them with the image of the lifestyle to which they too might aspire. In that research, most participants indicated that they had family members involved in the industry and had colleagues or knew of other young people working in the construction industry. Therefore, those who have family members and friends in the industry were more likely to have personalized knowledge of specific trades and clearer image of job culture and lifestyle (Taylor 2005).

As Yng Ling et al. (2015) mentioned, there are some incorrect perceptions towards the construction industry. One of the goal of this study is to compare the perception of young people who are inside the industry with those who are outside. This may help the construction industry to give more realistic image to the outsiders.

2.3.3 Theory of Planned Behavior

I use the theory of planned behavior as a theoretical framework to analyze how young people make a decision to choose a career in the construction industry. I chose this theory because career decision is mainly affected by the individual's perception, social influence, and mental barriers. In psychology, the theory of planned behavior is used to explain the relationship among beliefs, attitudes, and behaviors (Ajzen 1991). According to this theory, to predict an individual's behavior, we need to understand the underlying

factors of intention or motivation. Ajzen (1991) suggested that the intention has three determinants: 1) attitude which indicates how much an individual has a favorable or unfavorable evaluation of the behavior, 2) subjective norm, which is the perceived social pressure to perform or not to perform that behavior, and 3) perceived behavioral control, which reflects the individual's perception of difficulty of performing the behavior. This theory has been used in various fields in civil engineering, such as transportation, to explain speeding behaviors of drivers in highways (Zhu et al. 2011), pedestrian's unsafe behaviors in urban traffic system (Li et al. 2009), travel mode choice behavior (Zhao 2011), and safety behavior in construction sites (Fang 2016). It also has been applied in several studies to describe career-related decisions (Gelderen et al. 2008, Zellweger et al. 2011, Chen et al. 2016).

2.4 RESEARCH METHOD

The survey method was used to understand what factors might potentially influence a person's decision to choose a long term career in the construction industry. The jobs included in this study are limited only to the construction trades such as carpenter, electrician, ironworker, painter, pipefitter, and welder. The theory of planned behavior was used as a theoretical framework to design the survey questionnaire. Factors were identified based on a thorough literature review and discussion within a research team, which included eleven subject matter experts involved with workforce development in construction with an average of 28 years of industry experience. Figure 1 demonstrates the theoretical framework of this research.

The survey and research framework was reviewed and approved by the university Institutional Review Board (IRB). After conducting a pilot test and receiving feedback, the final version of the questionnaire was developed. Both electronic and paper-based questionnaires were prepared and distributed between the months of January and September 2016. The target population for our research was young people between the ages of 15 and 24 years (i.e., the age of career selection). Surveys were collected across the country through various efforts such as recruiting events, participants in formal construction training programs, and career and technical education competitions. These young people comprise the future

workforce for the construction industry. A total of 778 responses were collected from different participants across the US. The survey gathered information on demographic background, intention to choose to work in the construction industry, potential factors that influence attitude towards the construction industry, influence of other people important in individual's life (e.g. family, spouse/partner, friends, teachers, and school counselor), and mental factors that might control individual's decision to choose to work in the construction industry. I asked participants 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.

2.5 RESULTS

The sample includes 87% males and 11% females (two percent did not identify their gender). Twenty-two percent of respondents are between 15 to 17 years old and the other 78% are between 18 to 24 years old. In terms of ethnicity, distribution of respondents is 71% White/Caucasian, 16% Hispanic/Latino, 8% African American, 3% Indian American, and 1% Asian. Most of the subjects in our sample (86%) 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 2 shows the distribution of respondents based on work experience in any construction-related jobs.

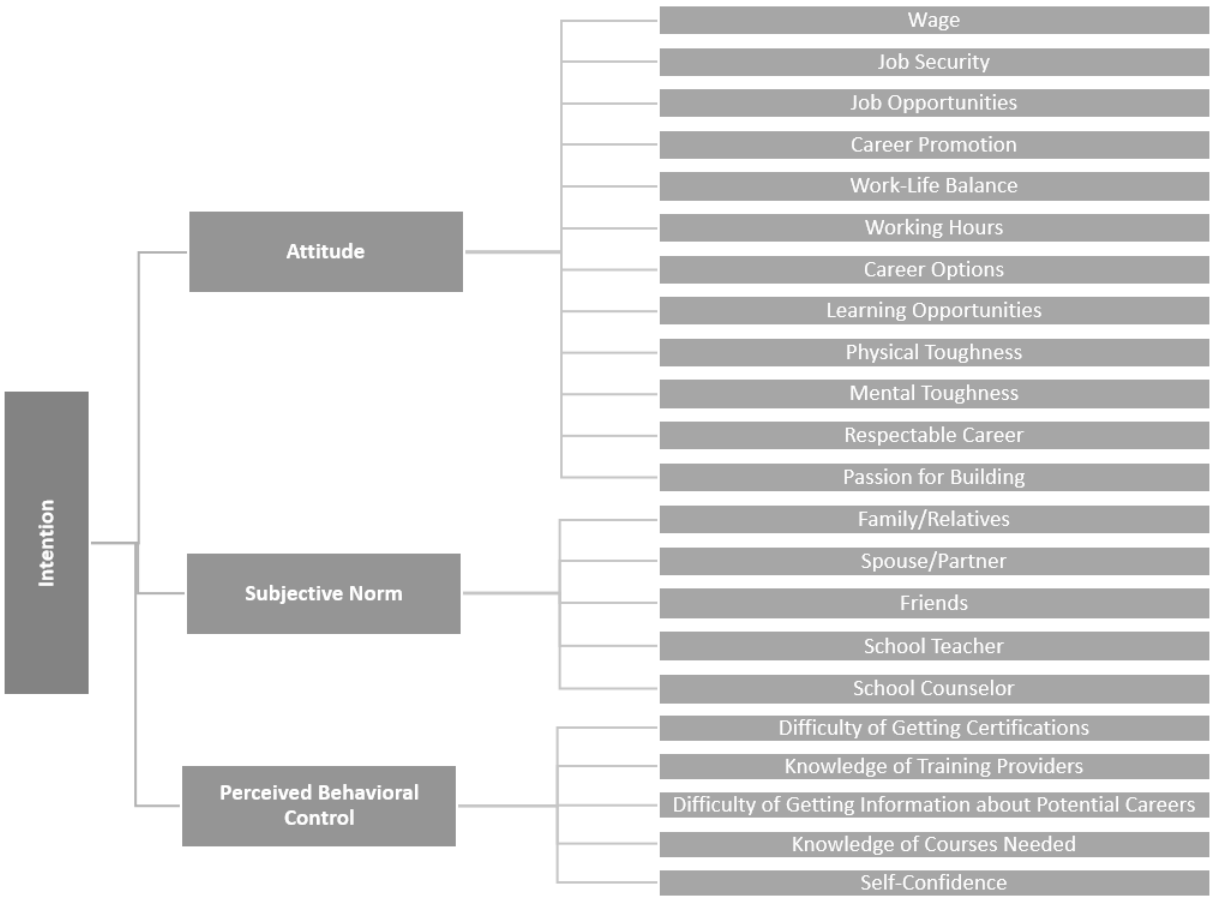

Figure 1: Research Framework

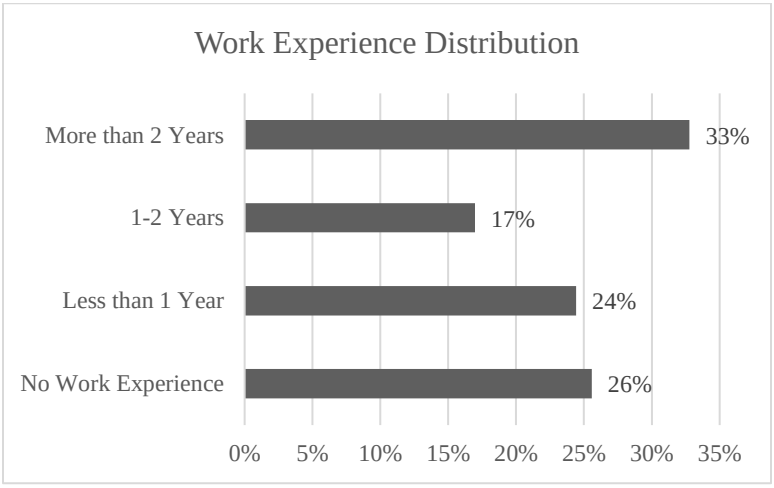

Figure 2: Distribution of Respondents Based On Construction Work Experience

2.5.1 The Theory of Planned Behavior Framework to Understand the Career Decision

2.5.1.1 Intention and Work Experience

Respondents were asked to indicate how likely they are to choose a career in the construction industry. ANOVA analysis proved that people with different levels of exposure to any construction-related jobs are significantly different in terms of intention to choose a career in the construction industry (Table 2).

Moreover, post hoc comparisons using the Tamhane's T2 test indicated that the mean of intention for the group with no work experience (mean= 4.89) was significantly lower than the other groups (Figure 3). The mean of intention for the group with less than one year of work experience (mean= 5.77) was also significantly different from other groups. However, the mean score for the group with one to two years of work experience (mean= 6.18) did not significantly differ from the group with more than two years of work experience (mean= 6.13). The results show that just one year of work experience in the construction-related jobs has a positive and significant effect on the individual's intention to choose to work in the industry.

Table 2: ANOVA Analysis of Intention Based On Work Experience

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	205.136	3	68.379	31.508	.000
Within Groups	1668.9	769	2.17		
Total	1874.03	772			
Robust Tests of Equality of Means					
	F	df1	df2	Sig.	
Welch	27.672	3	399.597	.000	
Brown-Forsythe	32.755	3	684.984	.000	

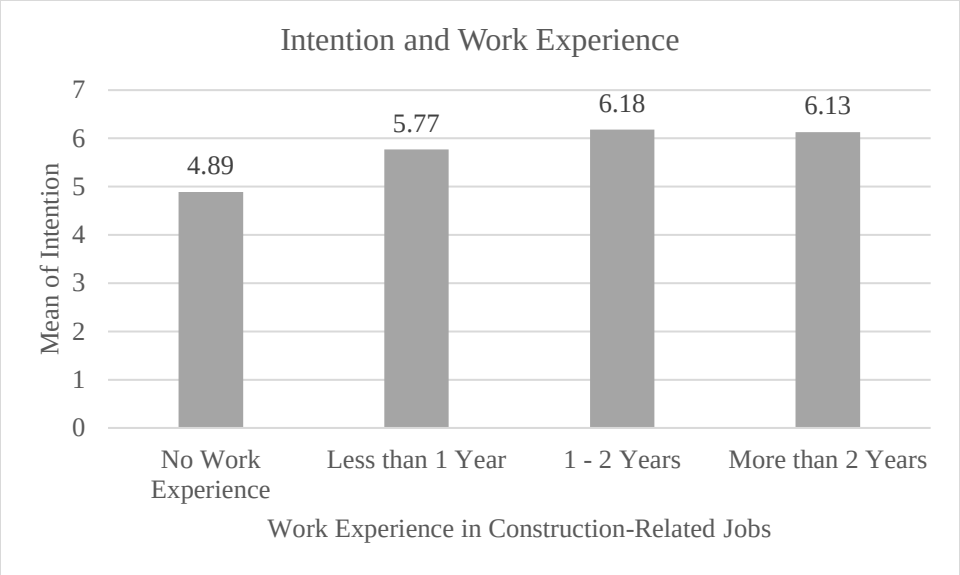

Figure 3: Intention and Work Experience

Statistical analysis indicates that in our sample, males (mean= 5.81) are more likely to choose a career in the construction industry than females (mean=5.12) regardless if they have work experience in construction-related jobs (sig. level = 0.000).

Among young people with some level of work experience in the construction-related jobs, people between the ages of 18 and 24 years (mean= 6.08) are more likely to pursue a career in the construction industry than people between the ages of 15 to 17 years (mean=5.22, sig. level= 0.000). This could be alarming for the construction industry and indicate that the industry is even less attractive to the upcoming generation. However, I did not see any significant difference across these two groups when they have no work experience.

I also examined the intention to pursue a career in the construction industry across different races. Among people with some work experience, ANOVA results show that there is significant difference between different races in terms of intention (Table 3). Figure four shows that working in construction is more attractive to Hispanics and Latinos (mean= 6.22) and less attractive to African Americans (mean= 5.23). However, we did not see any significant difference across different ethnic groups when they have no work experience.

Table 3: ANOVA Analysis of Intention Based On Ethnicity

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	29.143	3	9.714	4.491	.004
Within Groups	1397.26	646	2.163		
Total	1426.41	649			

Robust Tests of Equality of Means

	F	df1	df2	Sig.
Welch	4.593	3	83.5	.005
Brown-Forsythe	4.514	3	117.577	.005

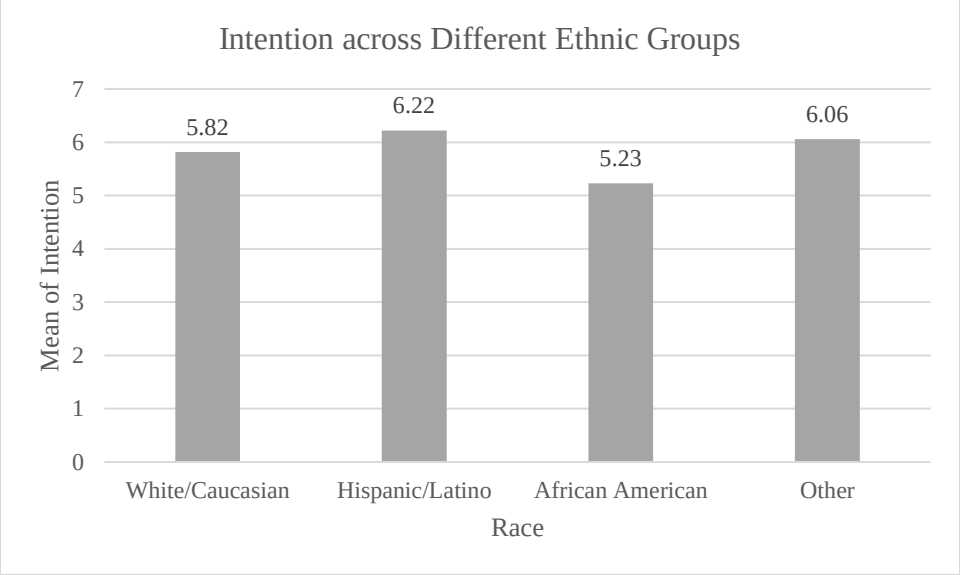

Figure 4: Intention across Different Ethnic Groups

2.5.1.2 Attitude towards Working in the Construction Industry

As mentioned earlier, according to the theory of planned behavior, one determinant of intention is attitude. In this research, I measured the overall attitude and its 13 components. The components of attitude measured in our research are mentioned in Table 4.

I find that overall attitude is highly correlated with the intention (Pearson Correlation Coefficient= 0.873, sig. level = 0.000). For those individuals who have either no or some work experience in any construction-related jobs, I find that the overall attitude of males and females is not significantly different. Nevertheless, in terms of components of attitude, there are several differences. Females believe that there are less opportunities for career promotion in the industry than males (sig. level = 0.017). Interestingly,

females think that working in the construction industry is less physically demanding than males (sig. level = 0.029). In comparison to male, females perceive that working in the construction industry is less mentally challenging (sig. level = 0.023). Passion for building measures the individual's inherent passion and interest to work with hand and build things. In this regard, I observed that males who participated in our research, are more passionate to build things than females (sig. level = 0.001).

I did similar analyses among males and females with some work experience in construction-related jobs. Here, I found that males have significantly more positive attitude towards working in the construction industry than females (sig. level= 0.012). Again, females evaluated working in the industry less physically and mentally challenging than males (with respectively significance levels of 0.000 and 0.021). In addition as women gain more exposure to the industry, they believe less than men do that working in the construction industry is a respectable career (sig. level = 0.035). Similar to previous results, males reported that they have more passion for building things than females (sig. level = 0.000).

Table 4: Overall and Components of Attitude for People With and Without Any Work Experience

	Without Work Experience		With Work Experience	
	Males	Females	Males	Females
Overall Attitude	5.53	5.25	5.99	5.47
Wage	5.57	5.63	5.74	5.83
Job security	4.97	4.89	5.13	5.11
Job opportunities	4.16	4.12	4.31	4.08
Career promotion	5.39	5.00	5.50	5.25
Benefits to society	6.06	5.97	6.19	6.08
Work-life balance	2.68	2.78	2.63	2.74
Working hours	1.69	1.88	1.59	1.67
Career options	5.74	5.83	5.91	5.97
Learning opportunities	6.00	6.15	6.15	6.24
Physical toughness	5.56	5.13	5.77	5.08
Mental toughness	5.18	4.70	5.29	4.91
Respectable career	5.96	5.72	6.06	5.73
Passion for building	6.03	5.30	6.33	5.50

Highlight: Mean difference is significant at the 0.05 level (2-tailed) between males and females at each category.

2.5.2 Subjective Norm

The respondants were asked to rate the degree to which family, spouse or partner, friends, schoolteacher, and school counselor encourage them to choose a career in the construction industry. I find that there are significant correlations between the intention and the degree of support they receive from these people (Table 5). I also examined if these correlation coefficients are significantly diffrent. To do this, I used the statistical method developed by Steiger (1980) to test differences between nonindependent correlations. The results indicate that there is no significant difference across correlation coefficients of intention and family support, intention and spouse support, and intention and friends support. However, these coeffitients are significantly different from correlations between both intention and school teacher support and intention and school counselor support (sig. level < .05, Lee and Preacher 2013). The results confirm that the role of familiy, spouse or partner, and friends are more important than others. These findings are compatible with previous studies indicating the role of family and friends in individual's career decision (Taylor 2005, Zafar 2011, Granitz et al. 2014). Interestingly, people with at least one family member in the construction industry are more encouraged by their families to choose a career in construction (sig. level= 0.002).

Table 5: Pearson Correlation Analysis of Intention and Subjective Norm

	Intention	Family/ relatives	Spouse/ partner	Friends	School teacher	School counselor
Intention	1	.370**	.347**	.350**	.255**	.190**
Family/relatives		1	.665**	.627**	.567**	.495**
Spouse/partner			1	.672**	.535**	.606**
Friends				1	.645**	.535**
School teacher					1	.698**
School counselor						1

***. Correlation is significant at the 0.01 level (2-tailed).*

2.5.3 Perceived Behavioral Control

In this section, I analyzed respondants' perception towards possible barriers that they might face in choosing a career in the construction industry. Results indicate that having knowledge about construction

training providers and courses needed to take to become a credentialed craft professional and confidence are significantly correlated with intention (Table 5). Young people with work experience in construction-related jobs are more likely to have a good knowledge of construction craft or apprenticeship programs (sig. level= 0.000) and are more likely to have good knowledge of courses required for becoming a craft professional (sig. level= 0.000). As discussed earlier, the concept of pragmatic rationality suggests that young adults are bounded to the information provided to them and pragmatically make career decisions based on partial information they have. In this regard, our findings demonstrate that the construction industry can overcome at least some of the mental barriers by providing more infromation to the public about how an individual can enter the industry and become a successful craft worker.

As illustrated in Table 6, intention has a high correlation with self-confidence (0.591). As described earlier, self-efficacy theory considers confidence as a strong predictor of a behavior (Bandura 1977). Also, Figure 5 shows that as people become more experienced in the construction industry, they become more confident in their abilities to be successful in the construction industry. This is also compatible with self-efficacy theory which implies that confidence can create a positive spiral in which persons with high confidence become more envolved in their tasks and then, in turn, strengthen their performance, which further increases confidence (Bandura 1977).

Table 6: Pearson Correlation Analysis of Intention and Elements of Perceived Behavioral Control

	Intention	*Difficulty of getting certifications*	*Knowledge of construction training providers*	*Difficulty of getting information about potential careers*	*Knowledge of courses needed to become craft professional*	*Self-confidence*
Intention	1	.009	.273**	-.051	.336**	.591**
Difficulty of getting certifications		1	-.178**	.402**	-.040	-.096**
Knowledge of construction training providers			1	-.215**	.574**	.338**
Difficulty of getting information about potential careers				1	-.149**	-.134**
Knowledge of courses needed to become craft professional					1	.438**
Self-confidence						1

***. Correlation is significant at the 0.01 level (2-tailed).*

In addition, I observed that young males (mean= 6.10) are generally more confident in their abilities to be successful in the construction industry than young females (mean= 5.66) with a significance level of 0.005. Intersetingly and yet once again, those who have at least one family member working in the construction industry, have more confidence in their abilities to be successful (sig. level = 0.006). This finding confirms that family members who work in an occupation can be a role model in that job for young individuals (Taylor 2005).

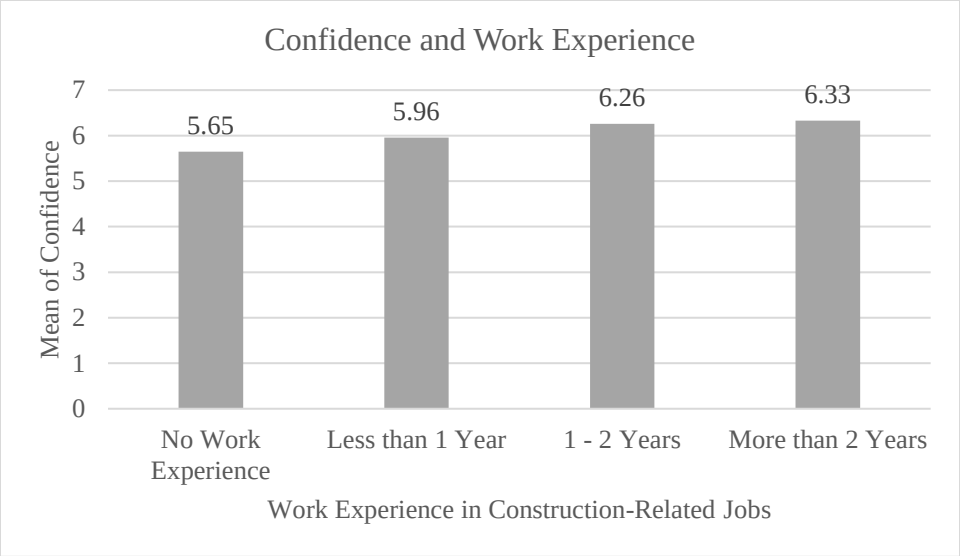

Figure 5: Confidence and Work Experience

2.5.4 Regression Model to Describe Attitude based on its Components

I used multivariate linear regression to examine the influence of different components of attitude on shaping the overall attitude towards choosing to work in the construction industry. To do this, we included these items as independent variables: 13 components of attitude along with variables indicating levels of work experience and gender. The dependent variable is the overall attitude towards choosing a trade-oriented career in construction. The backward elimination procedure was used to fit the best regression model to the data.

As Table 7 shows, the most influential factor is having more than one year of working experience. Again, this highlights the importance of early exposure to the industry. The most important component of attitude is passion for building. It is the inherent interest of an individual to build things. The results predict that those young people who are more interested in building things are more likely to choose a career in construction. Although some might expect that the higher wages in the industry might be the main reason to attract young people, the results are not surprising. The self-determination theory emphasizes the innate psychological needs as a main driver behind choices people make (Ryan and Deci 2000). Based on the self-determination theory, the interest and satisfaction from an activity itself is detrimental to accomplishing the task.

The second most important factor is the perception of the level of wage offered by the industry. In the next places, young individuals value the learning opportunities, benefits to society, and having a respectable career. Interestingly, the perception of working in construction as mentally challenging can improve the overall attitude where as its image as physically challenging can negatively influence the overall attitude.

The findings suggest that the new generation entering the industry places a significant emphasis on having a meaningful job that allows them to learn more and exercise their capacities rather than usual benefits such as job security and promotion opportunities. This is significant for the construction industry as recent research found that work accomplishment as one of the primary motivating factors for the construction workforce has been in decline for the past decade (Taylor, 2016). In addition, the industry can improve its image by promoting the advances in ergonomics and other human factors in recent years that make physical activities less challenging.

Table 7: Regression Analysis of Attitude

	B	Std. Error	Beta	t
Constant	-1.069	0.308		-3.472
Wage	0.297	0.045	0.228	6.654
Job security	0.079	0.035	0.071	2.258
Benefits to society	0.135	0.050	0.095	2.690
Learning opportunities	0.172	0.055	0.119	3.146
Physical toughness	-0.108	0.042	-0.084	-2.558
Mental toughness	0.102	0.035	0.091	2.907
Respectable career	0.114	0.050	0.084	2.302
Passion for building	0.330	0.040	0.276	8.229
WorkExpL1	0.285	0.106	0.089	2.682
WorkExpM1	0.458	0.093	0.167	4.898

Notes. R^2*=0.464, F-value= 64.835, Sig. level = 0.05*

The result of this section can help the industry in two ways. First, they provide guidelines for construction companies on how to communicate with the new generation in their recruiting activities. Overemphasis on relatively high wages offered by the industry to recruit new talents is not enough. The industry needs to highlight other benefits of working in the industry such as the sense of accomplishment

and building valuable things (e.g. infrastructure renewal), learning opportunities, and benefits provided to the society. Second, the industry needs to adopt new strategies to adjust workplaces that meet their wants and needs. Tulgan (2013) predicted Generation Z will bring profound challenges in every sector of the workforce. He emphasized on understanding these young workers entering the workplace and recommended some guidelines to deal with them. Compatible with our findings, the guidelines include initiatives such as providing continuing reeducation, retaining the most valuable new workers for the long term by building dream jobs, effectively using social media for recruiting, communication, training, development, performance management, and knowledge transfer, and adopting teaching style leadership to deal with Generation Z (Tulgan 2013).

2.6 CONCLUSION, RECOMMENDATIONS, AND LIMITATIONS

One of the challenges facing the construction industry is to attract new talents in order to sustain the availability of a qualified workforce. To attract young adults into the construction trades, the industry needs to understand the underlying factors behind people's decision to select a long-term career in the construction industry. In this research, I applied the theory of planned behavior to investigate this issue.

Here are the main findings of this research and their implications for the construction industry:

1) The overall attitude towards working in construction is highly correlated with the intention to choose a career in the industry. I also identified the components of the attitude and quantify the relative strength of these components. The results indicate that although wage are important, there are other more important factors that influence attitude. I found that the most important component of attitude is passion for building.

2) Regarding values, I find that the upcoming workforce gives the highest value to three factors of learning opportunities, benefits to society, and having a respectable career. These findings are important because they can guide the construction companies regarding the aspects of the jobs that should be emphasized in their recruitment activities. In addition, these findings have

implications for the way construction companies are treating young adults who have just entered the industry. In one study, Uwakweh (2006) found that construction apprentices' motivation to pursue a career in construction was low. To keep the young talent in the industry, construction companies should foster a workplace environment, which is compatible as much as possible with the expectations of the new generation.

3) Our results clearly show the importance of early exposure to construction-related jobs on the attitude and intention of young adults towards working in construction. Just one year of work experience can significantly improve the intention. This exposure to the industry helps young adults to better understand the job lifestyle and the image of work environment which are critical to career decision-making process (Taylor 2005). The construction industry can facilitate the exposure to the industry by providing more on-the-job training opportunities, pre-apprenticeships, apprenticeship, and pre-apprenticeship programs for young adults, especially in secondary education, and engaging in vocational training.

4) There are some differences between males and females in terms of components of attitude. One important difference is that males put more emphasis on passion for building than females do. Moreover, females perceive jobs in construction less mentally challenging. Again, these findings can help the industry understand how to communicate more effectively with males and females.

5) The results of this study also confirmed the influence of family members and friends in the decision making process. Especially, those who have at least one family member working in the industry become more encouraged to choose a career in construction. It indicates that if the industry wants to attract more young talents to construction, it also needs to influence their parents' perception towards construction.

6) Those who have a high motivation to choose a career in construction industry are also more confident about their future success in the industry. Therefore, it is important to increase self-confidence in young adults about their abilities. Self-efficacy theory provides some strategies to achieve this purpose. These strategies include enactive mastery, vicarious modeling, and verbal

persuasion (Bandura, 1997). Enactive mastery refers to the act of practicing in a task in order to improve one's confidence. Gaining relevant experience with the task or job can highly influence the feelings of self-confidence by improving self-competence towards a task. This is compatible with our results showing that as people become more experienced in the construction industry, they become more confident in their abilities to be successful in construction. This can again highlight the importance of providing on-the-job training in the construction industry. According to Bandura (1997), vicarious modeling occurs when an indiviudual becomes more confident by seeing someone else doing the task. The industry can adopt this strategy by featuring those young adults who are successful in construction through advertising campaigns. Also, the industry can boost self-confience by establishing formal and informal mentorship programs in which young adults can learn from someone who has the necessary experience (Bandura 1977, Saffold 2005). The third source of confidence is to convince an indiviual that she or he has the skills necessary to be successful (verbal persuasion). This highlights the role of supervisiors who are responsible for young workers who just arrived to the industry. They need to improve young adults' self-confidence by giving them positive feedbacks.

The goal of this research is to understand what factors influence younger generation to choose a career in construction industry as a craf professional . However, the sample of this research is mainly limited to those who were exposed to Career Technical Education (CTE) or participated in construction training programs. Although not all participants have work experience in construction or even know the industry very well, they are somewhat familiar with career opportunities in CTE. Further investigations using the same methodology can be done to understand how young people studying in high school and college without any background in CTE perceive working in the construction industry.

Moreover, all of these results are based on self-report and participants' perception. I do not have any data about their actual future decision to understand how their perceptions influence their final

decisions. Therefore, I heavily rely on prediction of Theory of Planned Behavior, which indicates the intention is highly correlated with the behavior. Nevertheless, in this research I cannot quantify this relation.

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3 FACTORS INFLUENCING CRAFTWORKERS' MOTIVATION TO PURSUE CAREERS IN THE CONSTRUCTION INDUSTRY

3.1 ABSTRACT

Work motivation is one of the most important aspects of management, but there is limited research that formally applies motivation theories to the construction industry. Since the U.S. construction industry is facing a skilled labor shortage, keeping craft workers motivated becomes even more crucial. However, U.S. construction firms may not have a clear understanding of the underlying drivers of motivation among their existing workforce. In addition, motivational factors may vary across different people. To benefit from various talents and skills, the industry needs to understand the difference in the motivational drivers of its diverse workforce. In this research, the researchers apply the theory of planned behavior to shed light on the underlying motivational factors that influence craft workers in the construction industry. The main purpose of this research is to identify these motivational factors and quantify their relative strengths. A survey instrument was designed based on the theory of planned behavior to measure 1) attitude, 2) subjective norm, and 3) perceived behavioral control and how these factors affect the individual's intention to pursue a career in construction. The survey was distributed nationally to 641 construction workers. The target population was craft workers above the age of 24 years. The results of the statistical analyses show that besides extrinsic motivational factors (e.g. wage), intrinsic factors such as learning opportunities, having a respectable career and benefits to society were the most important determinants of craft workers' attitude towards working in the construction industry. I also find differences in attitude based on gender and generation as the two main sources of diversity among craft workers. While there are significant differences based on gender and generation, all groups agreed that working in construction demands long working hours and challenging work-life balance. The results of this study can help the construction firms revise their human resource practices and increase the motivation of their current craft workforce.

3.2 INTRODUCTION

Several studies find that the U.S. construction industry is suffering from skilled workforce shortages (McGraw-Hill Construction 2012, Vereen 2013, Associated General Contractors of America

(AGC) 2015, Albattah et. al 2015). The shortage of skilled laborers hurts the industry in terms of project productivity, schedule, and safety (Karimi et al. 2016, 2017). One of the reasons for the skilled workforce shortage is the industry exit of workers to other industries (Druker & White 1996, McGraw-Hill Construction 2012).

The reasons why people have remarkably low motivation yet remain in their jobs vary across different industries (Dessler 2013). To keep people motivated to work in construction, the industry must manage a variety of motivational factors. However, previous studies have shown that there are differences between what employers think as their employees' motivational factors and what employees want from their jobs (Dessler 2013). One study among 262 U.S. organizations asked both employers and their employees to rank reasons behind employees' leaving their jobs (Watson Wyatt 2006). Employees' top five reasons included: 1) wage, 2) promotional opportunities, 3) work life balance, 4) career development, and 5) health care benefits. However, employers believe that the top five reasons were: 1) promotion, 2) career development, 3) wage, 4) relationship with supervisor, and 5) work life balance. This incomplete understanding of employees' motivational factors can result in ineffective human resource practices to keep employees motivated. One of the main goals of this research is to provide the construction firms with an in-depth look at motivational factors of craft workers.

Nowadays, diversity in the workplace is among the main challenges in managing people (Noe et al. 2011, Dessler 2013). Despite the challenges to human resource management, many US companies have acknowledged and utilized the diversity of its labor force to benefit from its talents and skills and gain competitive advantage in their businesses (Noe et al. 2011). New approaches in human resource management require companies to proactively segment their employees and provide customized human resource policies according to their needs (Dessler 2013). To adopt a segmentation approach, construction companies should understand the needs and desires of different segments of their employees. In this study, I examine the effect of gender and generation as two sources of diversity among craft workers in the construction industry.

Gender diversity is one of the important factors that needs careful examination. The percentage of women in construction trades has remained almost the same from 1983 to 2010 (National Women's Law Center, 2012). This creates a major contrast between jobs in the construction industry and other industries regarding gender diversification. In fact, the percentage of women in many occupations outside of construction that used to be more male-dominated have increased during the same time period (i.e., 1983 to 2010). Although some studies have focused on examining motivational factors among craftswomen in construction (Dabke, et al. 2008, Wangle 2009), we find no specific study to investigate differences between males and females' attitude towards working in construction. Since attracting female talents to the industry can be one of the remedies to workforce shortage facing the industry (Schleifer 2002), understanding the differences between males and females attitude is the key to customizing human resource practices in the construction companies.

In addition to gender diversity, I examine the diversity of viewpoints among different generations. I analyzed the differences in perceptions on different aspects of working in construction among three generations, including Generation Y (Born 1977 to 1995), Generation X (Born 1965 to 1976), and Baby boomers (Born 1946 to 1964). These groups mainly compose the current workforce in the construction industry. From a generational perspective, a recent study on 1,700 US workers conducted by Gallup (2016) showed that different generations expected different things from their jobs. The study specifically examined the expectations of millennial workers or Generation Y. According to this study, the two factors of: learning and growth opportunities and managerial quality are the most important factors they look for in their job search (Gallup 2016). Likewise, the analysis of attitude across craft workers from different generations allows construction companies to design more customized policies.

To examine what factors might influence craft workers' decisions to pursue a career in the construction industry, I applied the theory of planned behavior. This theory enabled us to study motivational factors related to career decisions by considering the role of perception, social influence and mental barriers

on job selection (Ajzen 1991). I also examined the attitudinal factors based on gender and generation. The results can help the industry to gain a thorough understanding of craft workers' wants and needs.

3.3 LITERATURE REVIEW

3.3.1 Work Motivation in the Construction Industry

Work motivation is one of the most important and challenging aspects of management (Robbins & Judge 2015). Not surprisingly, it has received significant attention over the past several decades in the field of human resource management, psychology and organizational behavior (Kanfer et al. 2012). However, relative to these fields, there is limited research that applies motivation theories to the construction industry (Navarro 2009). Work motivation is subject to change as a function of external forces such as workplace environment, economic situation, industry, and technological trends (Ilgen & Pulakos 1999). Therefore, the need to examine and apply more recent motivation theories in the field of construction becomes even more essential.

From the perspective of workforce shortage, it is well researched that people who are more dissatisfied with their jobs are more likely to leave (Dessler 2013). In addition to the impact of motivation on workforce retention, several studies have emphasized the importance of motivation as one of the major factors that can affect productivity in the construction industry (Borcherding & Oglesby 1974, Borcherding 1976, Dai et al. 2007, Barg et al. 2014,). Improving motivation can also reduce absenteeism and turnover and enhance workers' engagement in the job, achieving project goals, and team cohesion (Maloney & McFillen 1985, 1986 (a), 1986 (b), Leung et al. 2008).

Robbins and Judge (2015) defined motivation as "the processes that account for an individual's intensity, direction, and persistence of effort toward attaining a goal." Motivation can be classified into two different categories: intrinsic and extrinsic. Intrinsic motivation is the inherent desire to involve in new activities and challenges, to exercise one's capacity, to explore and to acquire knowledge. It is driven by an

interest and satisfaction from the activity itself. On the other hand, extrinsic motivation comes from outcomes of the activity such as money and other external rewards (Ryan & Deci 2000).

There are different theories in the field of organizational behavior and psychology that can be used to predict, formulate, and influence employee motivation. However, researchers have mostly applied Maslow, Herzberg and Vroom's motivation theories to the construction workers (Navarro 2009, Barg et al 2014). Maslow's hierarchy of needs theory suggested that humans have a hierarchy of five needs: physiological, safety, social, esteem and self-actualization. Maslow argued that to motivate people, we need to understand what level of the hierarchy people are currently on and focus on fulfilling needs at or above that level (Robbins & Judge 2015). Two-Factor Theory, developed by psychologist Frederick Herzberg, tried to explain what factors influence job satisfaction. Herzberg related an individual's satisfaction with the work to intrinsic factors and associated dissatisfaction to extrinsic factors (Robbins & Judge 2015). Expectancy theory argued that an individual's behavior results from conscious choices among alternatives whose goal is to maximize pleasure and to minimize pain. According to Vroom, the strength of motivation towards an act in a certain way depends on two factors: the strength of individual's expectation from the outcome of the act and the attractiveness of that outcome to the individual (Vroom, 1964).

Early studies in this field indicated that motivational mechanisms were poorly applied among construction workers (Maloney & McFillen 1985, 1986 (a)). These studies recommend construction firms to adopt new approaches such as using positive rewards or enriching jobs rather than traditional approaches which rely more on punishment and discipline (Maloney & McFillen 1986 (a)).

Different studies conducted on motivational factors among construction workers suggest that there is a need to balance extrinsic and intrinsic factors. As an important intrinsic factor, Borcherding & Oglesby (1974) discovered "identification to constructing a unique structure" to have an important effect on the satisfaction of workers, especially at supervisory levels (Borcherding & Oglesby, 1974). Likewise, in another study, tradeswomen in carpentry reported that they were proud of their effort because it resulted in

building a structure (Dabke, et al. 2008). Goodrum's (2003) study examined the factors that affected job satisfaction of U.S. construction worker through the 1970s, 1980s, and 1990s, using the data from the General Sociological Survey (GSS). The results of this study indicated that a sense of accomplishment was the most important driver of job satisfaction. However, this driver is stronger among management occupations and well-educated workers. The second most important motivational factors are extrinsic motivation. High income, followed by chances for advancement, job security, and short working hours are among the extrinsic factors influencing motivation (Goodrum 2003). A research done by Shan and Goodrum (2010) using GSS dataset, provided support for the effect of income on motivation and job satisfaction. The results of this study showed that among different construction workers, those who had higher annual income reported themselves as more satisfied with their job compared to workers with lower income.

The effect of age on motivational factors across construction workers is not very clear. On the one hand, Chileshe and Haupt (2010) found no differences between younger and older construction workers in South Africa in terms of factors contributing to the job satisfaction. Both groups reported personal development and quality of life as the two most important job satisfaction factors. On the other hand, a research conducted by Shan and Goodrum (2010) indicated a larger percentage of construction workers in U.S. who were 44 years or older were satisfied with their jobs compared to younger workers. Similarly, Chih et al. (2016) who used the concept of psychological contract found that younger construction workers are more sensitive to psychological contract breach. Psychological contract is an unwritten agreement that exists between employers and employees and reflects their mutual expectations (Dessler 2013). It seems younger workers are more likely to experience greater levels of emotional exhaustion and exit their organizations if psychological contract breaches (Chih et al. 2016). The differences in results could be attributed to the fact that these studies were conducted in different geographical locations.

Some studies have specifically focused on understanding motivational factors among women working in the field. The perception of construction professionals in the U.S. towards women working in

the trades appears to have improved, but there is little evidence that construction firms are broadly recruiting women and consider them as a potential skilled labor source (Dabke, et al. 2008, Wangle 2009). One study across 39 tradeswomen from the Cincinnati area suggested that pay, benefits, and job security are most important factors for predicting women's satisfaction with their occupation (Dabke, et al. 2008). Other important factors included having personal safety equipment, opportunities to learn new things, opportunities to develop skills, and separate hygienic sanitary facilities on job sites.

It also seems that construction firms pay little attention to motivating those who have just entered the industry. In a survey of construction apprentices, the overall motivational scores of participants were recorded as low. The study suggested that construction firms did not offer a variety of rewards to apprentices. They also provided little support for the apprentices to learn better and stay in the trade (Uwakweh 2006).

As Brandenburg et al. (2006) discuss, construction firms need to adopt more structured human resource development programs and see skilled craft workers as their strategic assets. One antecedent to this paradigm shift is that the industry gains more understanding of the motivational drivers of its workforce. This paper tries to describe the factors underlying current craft professionals' decision to continue their careers in the construction industry.

3.3.2 Theory of Planned Behavior

I use the theory of planned behavior as a theoretical framework to analyze how the current workforce makes a decision to either leave the industry or continue their careers. This framework allowed us to consider attitudinal factors, social influence, and mental barriers underlying career decisions. In psychology, the theory of planned behavior is used to explain the relationship among beliefs, attitudes, and behaviors (Ajzen 1991). According to this theory, we need to understand the underlying factors of intention and motivation in order to predict an individual's behavior. Ajzen (1991) suggested that the intention has three determinants: 1) attitude, which indicates how much an individual has a favorable or unfavorable

evaluation of the behavior, 2) subjective norm, which is the perceived social pressure to perform or not to perform that behavior, and 3) perceived behavioral control, which reflects the individual's perception of difficulty of performing the behavior.

Several studies applied this theory to analyze job search and reemployment behavior (Vinokur & Caplan 1987, Van Hooft et al. 2004 (a), 2004 (b), Song et al. 2006). This theory has also been used in various fields in civil engineering to explain speeding behaviors of drivers in highways and roads (Zhu et al. 2011), pedestrian's unsafe behaviors in urban traffic system (Li et al. 2009), travel mode choice behavior (Zhao 2011), and safety behavior in construction sites (Fang 2016).

3.4 RESEARCH METHOD

The survey method was used to understand what factors might potentially influence a person's decision to choose a long term career in the construction industry. The jobs included in this study are only limited to the construction trades such as carpenter, electrician, ironworker, painter, pipefitter, and welder. The theory of planned behavior was used as a theoretical framework to design the survey questionnaire. Factors were identified based on a thorough literature review and discussion within a research team, which included eleven subject matter experts involved with workforce development in construction with an average of 28 years of industry experienceU Figure 6 demonstrates the theoretical framework guides this research.

The survey and research framework was reviewed and approved by the University Institutional Review Board (IRB). After conducting a pilot test and receiving feedback, the final version of the questionnaire was developed. Both electronic and paper-based questionnaires were prepared and distributed between the months of January and September, 2016. The target population for our research was craft workers above the age of 24 years. Our surveys were distributed among craft workers who were participating in training programs across different construction companies in the U.S. A total of 641 responses were collected. The survey gathered information on demographic background, intention to

choose to work in the construction industry, potential factors that influence attitude towards the construction industry, influence of other people important in each individual's life (e.g. family, spouse/partner, friends, teachers, school counselor, and training program instructor), and mental factors that might control the individual's decision to choose to work in the construction industry. I asked participants 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.

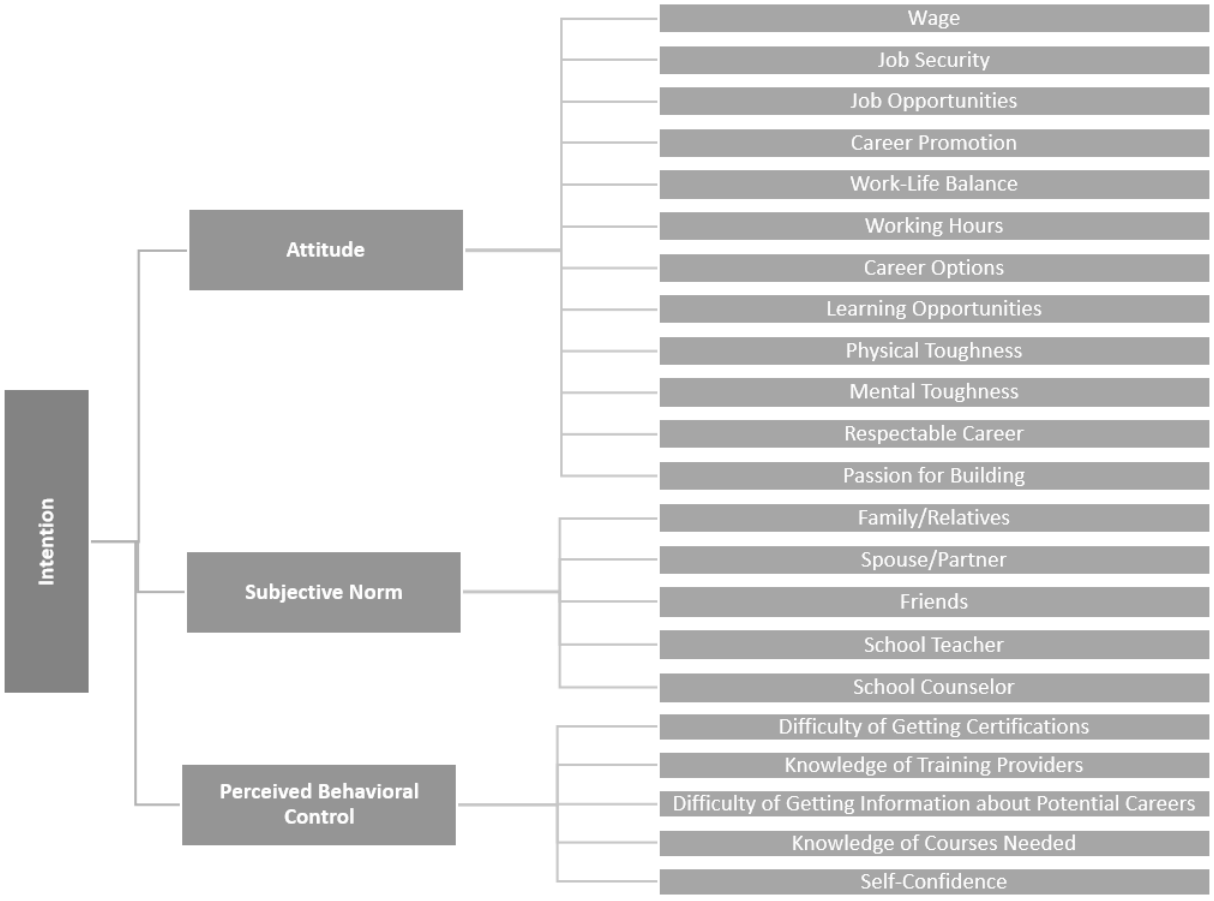

Figure 6: Research Framework

3.5 RESULTS

I analyzed the demographics of participants based on gender, generation, ethnicity, education, and number of years of work experience in construction-related jobs. The sample includes 89.4% males and

10.6% females. The respondents were categorized based on generations: Generation Y (Born 1977 to 1995), Generation X (Born 1965 to 1976), and Baby boomers (Born 1946 to 1964). Figure 7 shows the distribution of respondents based on different generations. In terms of ethnicity, distribution of respondents is 64.9% White/Caucasian, 15.4% Hispanic/Latino, 12.2% African American, 7.4% other races. In terms of the highest level of education they attained, Figure 8 illustrated the distribution of people in different categories. Moreover, most of the subjects in our sample (69%) reported that they have more than five years of work experience in any construction-related jobs. Only 6% have less than one year of work experience.

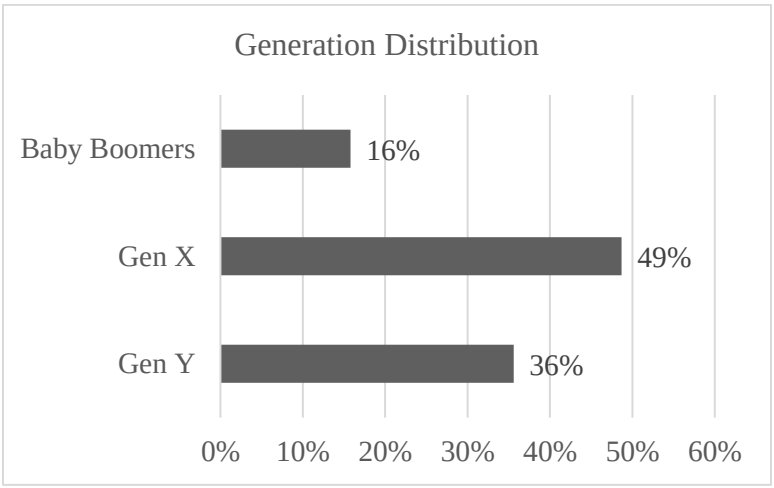

Figure 7: Distribution of Respondents Based On Generation

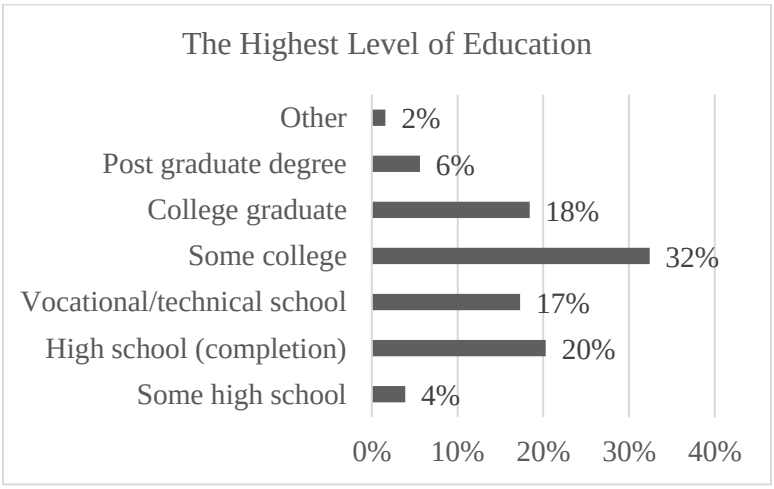

Figure 8: Distribution of Respondents Based On the Highest Level of Education

3.5.1 Attitudinal Factors and Motivation

According to the theory of planned behavior, one determinant of intention is attitude. In this research, I measured the overall attitude and 13 components of attitude mentioned in Figure 1. Overall attitude measures the degree to which the respondents believe that pursuing a career in the construction industry seems a good decision for them. Our analysis showed that it is highly correlated with the motivation of individuals to continue their career in construction (Pearson correlation = 0.711, sig. level = 0.000).

3.5.1.1 Attitudinal Factors Based On Gender

I was interested to know if people's perception towards different aspects of working in construction varies among females and males. Although I could not find any significant differences in overall attitude between the two groups of females and males, there are some differences in terms of components of attitude (Table 8).

Statistical analysis indicated that compared to females, males are more likely to perceive the construction industry as providing jobs that benefit the society (sig. level = 0.043). Generally, females are more concerned about long working hours than males (sig. level = 0.022). Furthermore, females in our sample think that working in the construction industry is less physically demanding than males (sig. level = 0.005). We also observed that men are more likely than women to believe that working in the construction industry is a respectable career (sig. level = 0.029).

Passion for building measures the individual's inherent passion and interest to work with hand and build things. In this regard, I found that males who participated in our research are more passionate to build things than females (sig. level = 0.011).

It is worthwhile to note that both males and females gave relatively low scores among the following items: working hours, work-life balance, and job securities. These results indicate that both groups perceived that working in construction requires long working hours and challenges in the balance between

work and life. They also perceived that the risk of becoming unemployed in the construction industry is relatively high per their attitudinal scores related to job security.

Table 8: Components of Attitude Based On Gender

Females		Males	
Wage	6.07	Passion for building	6.31
Learning opportunities	5.94	Respectable career	6.15
Passion for building	5.90	Benefits to society	6.11
Respectable career	5.87	Learning opportunities	5.98
Benefits to society	5.82	Physical toughness	5.85
Career option	5.76	Career option	5.83
Physical toughness	5.45	Wage	5.82
Career promotion	5.34	Mental toughness	5.51
Mental toughness	5.24	Career promotion	5.29
Job opportunities	5.03	Job opportunities	5.09
Job security	4.79	Job security	4.82
Work-life balance	3.16	Work-life balance	3.08
Working hours	2.16	Working hours	2.49

3.5.1.2 Attitudinal Factors Based On Generations

The results of this section show how three generations perceive different aspects of working in the construction industry. Table 9 summarized the results. I found that just five out of 13 components of attitude have no statistical difference across different generations. These components include wage, work-life balance, working hours, physical toughness, and respectable career. The results indicate different generations are relatively satisfied with the level of wages offered by the industry. In addition, the respondents indicate that by entering construction, they can have a respectable career. On the other hand, there is a consensus that working in the construction industry makes it challenging to balance work and personal responsibilities. Likewise, all generations believe that working in the industry demands long working hours and high levels of physical endurance.

However, in terms of other factors, Generation X has a relatively pessimist approach towards working in construction. Generation X has a less favorable evaluation of job security, job opportunities, career promotion, benefits to society, and learning opportunities provided by construction. In addition,

people in our sample from Generation X rated themselves less passionate for building things. On the other hand, Generation Y evaluated working in the industry less mentally challenging than other generations.

Table 9: Components of Attitude for Different Generations

Components of Attitude	Generations	Sample Size	Mean	F	P value
Wage	Gen Y	228	5.87		
	Gen X	311	5.83	.115	.891
	Baby Boomers	100	5.86		
Job security*	Gen Y	228	5.07		
	Gen X	311	4.63	6.414	.002
	Baby Boomers	101	4.76		
Job opportunities*	Gen Y	228	5.06		
	Gen X	310	4.98	3.173	.043
	Baby Boomers	101	5.41		
Career promotion*	Gen Y	228	5.52		
	Gen X	311	5.09	7.641	.001
	Baby Boomers	101	5.35		
Benefits to society*	Gen Y	228	6.22		
	Gen X	310	5.95	5.390	.005
	Baby Boomers	101	6.10		
Work-life balance	Gen Y	228	3.22		
	Gen X	311	3.03	1.732	.178
	Baby Boomers	100	2.90		
Working hours	Gen Y	228	2.40		
	Gen X	311	2.45	1.064	.346
	Baby Boomers	100	2.59		
Career option*	Gen Y	227	5.98		
	Gen X	310	5.75	4.404	.013
	Baby Boomers	101	5.69		
Learning opportunities*	Gen Y	228	6.11		
	Gen X	311	5.88	3.353	.036
	Baby Boomers	99	5.98		
Physical toughness	Gen Y	228	5.78		
	Gen X	308	5.83	.195	.823
	Baby Boomers	101	5.82		
Mental toughness*	Gen Y	228	5.32		
	Gen X	311	5.59	3.724	.025
	Baby Boomers	101	5.50		
Respectable career	Gen Y	228	6.21		
	Gen X	311	6.05	1.667	.190
	Baby Boomers	101	6.14		
Passion for building*	Gen Y	228	6.38		
	Gen X	311	6.16	4.246	.015
	Baby Boomers	101	6.34		

** Mean difference is significant at the 0.05 level (2-tailed).*

3.5.2 Regression Model to Describe Attitude based on its Components

The purpose of this section is to quantify the relative importance of attitude dimensions. To do this, the linear regression method has been applied. The dependent variable is the overall attitude towards choosing a trade-oriented career in construction and 13 components of attitude were considered as independent variables. The backward elimination procedure was used to fit the best regression model to the data. The results are illustrated in Table 11.

Table 10: Regression Analysis of Attitude

	B	Std. Error	Beta	t
Constant	.873	.314		2.780
Wage	.109	.041	.107	2.640
Job security	.084	.028	.114	3.018
Benefits to society	.112	.046	.100	2.467
Career option	.090	.046	.082	1.955
Learning opportunities	.161	.046	.152	3.492
Respectable career	.140	.044	.131	3.214
Passion for building	.201	.044	.170	4.564

Notes. R^2*=0.340, F-value= 45.441, Sig. level = 0.05*

Seven components out of 13 became statistically significant in predicting the overall attitude.The most important factor is the passion for building which is the inherent interest of an individual to build things. This is compatible with the previous research which emphasize the sense of accomplishment and satisfaction with building a structure as the main sources of motivation for construction workers (Borcherding & Oglesby 1974, Goodrum 2003, Dabke, et al. 2008). Opportunities to learn and grow at work are also highly important to construction workers. The next most influences factors on attitudes are having a respectable career and providing opportunities to benefit the society. Interestingly, wages and monetary rewards are in the next level. Having different career options is also among influential factors of attitude. It gives the flexibility to an individual to have more occupational positions and develop and use different sets of skills over years. The last influential factor on motivation is job security.

Our findings indicate that intrinsict factors are generally more influential than exrinsict factors on craftworkers' attitude. These results are consistet with the predictions of self-determination theory.

According to this theory, intrinsict motivation produces a deeper sense of engagement in activities (Ryan and Deci 2000). However, the thoery suggests that the environmental and extrinsic factors can either help indivduals to actualize their inherent potentials and needs or hinder the achievement of psychological needs which underlie intrisnisic motivation. This is important because it implies that construction companies need to provide an environment where their workforce can actualize their inherent needs mentioned in this section.

3.5.3 Subjective Norm

The respondents were asked to rate the degree to which significant others, including family, spouse/ partner, friends, and training program instructors encouraged them to pursue a career in the construction industry. I found that there are significant correlations between the intention and the degree of support they receive from these people (Table 11). I used the statistical method developed by Steiger (1980) to test if these correlation coefficients are significantly different. The results indicate that there is no significant difference across these correlation coefficients. The results suggest that the influences of family, spouse/partner, friends, and training program instructors on individual's career decision are relatively the same. The correlations between supports received from family, spouse/partner, friends and instructors are also high. This means that they received relatively consistent support from their social environment.

Table 11: Pearson Correlation Analysis of Intention and Subjective Norm

	Intention	Family/ relatives	Spouse/ partner	Friends	Training program instructors
Intention	1	.238**	.195**	.258**	.199**
Family/relatives		1	.647**	.611**	.515**
Spouse/partner			1	.593**	.557**
Friends				1	.556**
Training program instructor					1

***. Correlation is significant at the 0.01 level (2-tailed).*

3.5.4 Perceived Behavioral Control

To understand the effect of perceived behavioral control on the intention to pursue a career in construction, I investigated the individuals' beliefs about difficulty of getting the required certificates and acquiring information on training programs and potential careers in construction. I also wanted to know the effect of self-confidence in their abilities and skills on their intention.

With respect to difficulty of getting certifications, no correlation was found between this factor and intention. In addition, I did not find any correlation between intention and difficulty of obtaining information about potential careers in the industry. One possible explanation is that most people in our sample had more than five years of work experience. Therefore, it is highly probable that they already know the possible career opportunities.

As Table 12 indicates, the two factors of knowledge of construction training providers and knowledge of courses needed to become craft professionals have statistically significant correlations with the intention. In addition, the knowledge of courses has highly positive correlation with knowledge of training programs and negative correlation with difficulty of getting information about potential careers. This reflects that those who have a clear image of their career path have a better knowledge of their development opportunities. Considering the fact that opportunities to learn and grow at workplace are highly important to construction workers as our study results suggest, it is not surprising that those who have a better knowledge of development opportunities have higher intention to stay in construction.

The intention is also correlated with self-confidence. This result is consistent with self-efficacy theory, which considers confidence as a strong predictor of a behavior (Bandura 1997). According to this theory, self-efficacy has a central effect on human motivation and performance outcomes. Among these outcomes, achievement pursuit, development of intrinsic motivation, and successful career management can be mentioned (Bandura 1982).

Table 12: Pearson Correlation Analysis of Intention and Elements of Perceived Behavioral Control

	Intention	*Difficulty of getting certifications*	*Knowledge of construction training providers*	*Difficulty of getting information about potential careers*	*Knowledge of courses needed to become craft professional*	*Self-confidence*
Intention	1	.000	.117**	-.02	.209**	.302**
Difficulty of getting certifications		1	-.268**	.457**	-.178**	-.012
Knowledge of construction training providers			1	-.349**	.525**	.286**
Difficulty of getting information about potential careers				1	-.207**	-.090**
Knowledge of courses needed to become craft professional					1	.338**
Self-confidence						1

***. Correlation is significant at the 0.01 level (2-tailed).*

3.6 CONCLUSION, RECOMMENDATIONS, AND LIMITATIONS

To retain its talents, the construction industry needs to understand the craft workers' motivational factors. This understanding helps companies effectively manage human resource practices to keep craft workers motivated. This research investigated how craft workers perceive working in construction and how this perception influences their intention to pursue a long-term career in the industry. I also examined how people's attitude vary according to their gender and generation.

The results indicate that intention is highly correlated with the overall attitude. I found that seven components influence the overall attitude: passion for building, learning opportunities, having respectable career, benefits to society, wage, career options and job security. The implication for the industry is that we should not underestimate the intrinsic drivers of motivation. Although monetary rewards are important as the results of our study suggest, they are not sufficient to serve as the primary factor to motivate craft workers to work in construction. Construction firms need to foster a work environment that encourages

employees' learning and development and provide jobs that are more meaningful. In addition, our results indicate that construction workers appreciate having a flexible career, which allows them to develop and use different sets of skills. It might also help them reduce the risk of being unemployed by increasing their marketable skills. Another important finding is related to job security. As previous studies indicate, construction industry has not done well in providing job security to its workers. Our findings demonstrate that job security is an important factor in shaping craft workers' attitude towards pursuing their career in the industry.

Our study show differences in viewpoints based on gender. Females and males do not perceive some aspects of working in construction similarly. Craftswomen in our sample rate benefits to society, working hours, and having respectable career lower than men. This might be due to the nature of the jobs assigned to women in the industry. Previous Studies shows that the construction industry was not as successful as other male-dominated industries to attract women (National Women's Law Center 2012). Since attracting women to the industry could be one of the remedies of current workforce shortages in the industry, construction companies need to customize their human resource initiatives to attract more women.

In terms of generations, Generation X has a relatively pessimistic attitude towards the industry in several aspects. Since this generation includes the core body of the current workforce in the industry, construction companies must pay special attention to them. Considering the knowledge and skills accumulated in this generation, losing people from this generation could be costly for companies.

I also found that the decision to stay in the industry is not an isolated decision. This decision is influenced by the social environment around the craft workers. Nevertheless, there is no any significant difference between influence of different parties (i.e. family, spouse/partner, friends and instructors). This means that receiving a consistent positive or negative feedback can influence the decision to stay or leave the industry.

Finally, the effect of perceived behavioral control was examined. Those who have a better knowledge of development opportunities have higher intention to stay in construction. This shows that the industry not only should provide better development opportunities for craft workers but also should better communicate them to the people. Moreover, self-confidence is an important factor influencing the intention. If people have more confidence on their abilities to become successful in construction, they are more willing to pursue their career in the industry. Construction companies can design mechanisms to effectively improve self-confidence among their workers. Giving feedback through formal mechanisms such as performance management systems or informal mechanisms such as mentorship programs can be effective ways to ensure craft workers about their abilities and identify possible areas for improvements. In order to improve feedback effectiveness, it is recommended that feedback mechanisms be accompanied with learning and development opportunities (Dessler 2013). In this way, construction companies can increase self-confidence and motivation through creating an amplifying loop by giving appropriate feedback and providing learning opportunities to strengthen the effect of each other.

In this research, I employed the theory of planned behavior to understand on the underlying motivational factors that influence craft workers in the construction industry. One of the limitations to this study is our sample. Most of the participants in this research are those craft workers who were participating in training programs. It is reasonable to assume that those who attend these programs have considered long-term career in construction and have relatively positive perception towards the industry. Further investigations can use the same methodology applied in this research and include those craft workers who had worked in construction and then left the industry to find the jobs in other industries.

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4 CAREER SELECTION MODEL FOR CONSTRICTION CRAFT WORKERS: APPLICATION OF THE THEORY OF PLANNED BEHAVIOR

4.1 ABSTRACT

This study applied the Theory of Planned Behavior (TPB) to investigate how the current workforce and the next generation of craft workers make decision to pursue a career in the construction industry. A survey instrument was designed based on the TPB to measure 1) individual's attitude, 2) subjective norm, and 3) perceived behavioral control. The survey was distributed nationally and 1419 completed questionnaires were received. The target population for the survey include two groups: 1) individuals between the ages of 15-24 who were exposed to Career Technical Education (CTE) or participated in construction training programs (future workforce), and 2) craft workers above the age of 24 years (current workforce). Structural Equation Modeling (SEM) analysis was employed to analyze the data. I proved that the career selection model built based on TPB could explain considerable amount of variance in intention to pursue a career in construction for both groups. However, the relative importance of attitude, subjective norm, and perceived behavioral control was not the same for two groups. I applied multi-sample SEM to prove that the difference between two models are statistically significant. As far as the authors know, this is the first career decision model for construction craft workers and the results of this study can help construction companies and the industry to improve their recruitment and retention policies and practices.

4.2 INTRODUCTION

The construction industry currently faces several challenges in areas of workforce development that can hamper its sustainability and growth. Several studies have documented shortage of skilled craft workers in construction (Construction Users Round Table 2001, McGraw-Hill Construction 2012, Construction Industry Institute 2015). More recently, the Associated General Contractors of America's (AGC) survey across 26,000 construction firms in 2017 reported that growing workforce shortages in construction have made it difficult to find qualified workers. The participants in that survey expected the workforce shortage would continue to be a challenge in the near future. Some studies also found that the

shortage has worsened to the level that it is not only hard to find qualified craft workers, but also negatively impacting projects' schedule, cost, and safety (Karimi et al. 2016, 2017, 2018).

The average age of craft professionals within the industry is increasing. The average age of the U.S. construction craft workers is increasing four times faster than all other industries during the last decade (Construction Industry Institute 2015). Part of this problem is because younger people are not so much eager to enter the industry and work in technical occupations. The other part of the problem is related to the fact that some skilled workers exit the industry and enter to other industries (Druker & White 1996, McGraw-Hill Construction 2012).

One of the goals of this study is to investigate how young talents who will form the future workforce pool for the construction industry make decision about choosing a career in the industry. Another goal is to understand how the current workforce who already work in the industry make decision to keep their career in the industry. I also want to know if there is a difference between these two groups in their career decision-making processes. If there is a difference between the career decision model of these two groups, it might imply that the industry need to treat the upcoming workforce differently in areas such as recruiting, placing, and training.

To fulfill these goals, I built a decision model for career selection across the future and the current construction workforce based on the Theory of Planned Behavior (TPB). Based on this theory, the decision is influenced by individual's attitude, subjective norms, and perceived behavioral control. I wanted to realize how all of these elements interact with each other and shape the decision. This model help to understand the underlying factors that influence people to choose a career as craft workers in the construction industry and their relevant importance.

To build the decision model based on TPB, I used the survey methodology and conducted Structural Equation Modeling (SEM) to analyze the data collected. SEM is a second-generation multivariate analysis technique used to determine the extent to which a priori theoretical model is supported by the sample data

(Schumacker & Lomax 2010). More specifically, SEM tests models that specify how groups of variables define a construct, as well as the relationships among constructs. I also employed multi-sample SEM approach to test the hypothesis that there is a statistically significant difference between two career decision models for future and current workforce.

In this paper, I first reviewed the literature review about career decision making and Theory of Planned Behavior. Then, I explain the research method and data collection process. Finally, I describe how I analyzed the data using SEM and multi-sample SEM and discuss the results.

4.3 LITERATURE REVIEW

4.3.1 Career Selection

Many young people experience challenges to find the right career path. There are different theories explaining how young people make decision about their career. Some theories have a highly rational approach to career decision making. One of the prominent theories from rational perspective is personality–job fit theory developed by John Holland. Holland categorized people in six personality types. He suggests that people need to clearly know their personality traits. Then they should select a job that fits their personal characteristics. The satisfaction and tendency to leave a job is determined by how well the person matches his or her personality traits to the job (Holland 1997).

However, there are other theories that claim career decision making is not a rational process as traditional vocational psychology described (Hodkinson and Sparkes 1997). They discussed that although young people are able to decide rationally regarding their careers, they have to pragmatically make decisions based on the partial information that is available to them (Hodkinson and Sparkes 1997). In reality, it seems that career-related decisions are made based on ideas, perceptions, and images that begin to form from early childhood. In this process, perceptions of reality, rather than reality itself, are critical to the decision (Foskett and Hemsley-Brown 1999). The perception about different careers can be shaped by the information people receive from family, friends, teachers and career counsellors, media, stereotypical

occupational images portrayed in film and entertainment (Hodkinson and Sparkes 1997, Kniveton 2004, Bright et al. 2005, Taylor 2005, Zafar 2011, Granitz et al. 2014). Although, they do not have the same influence on the decision.

Social learning theory of career development tries to describe career decision making from a learning perspective. From this perspective, people learn by observing other people's actions and the consequences for them (Bandura 1977). Therefore, the individual's career decision making is influenced by learning experiences, environmental conditions and events (Mitchell 1996).

Bandura's (1977) self-efficacy theory explains that a person's perception of her abilities to becoming successful in a certain situation or achieve a goal has a significant role in the way she deals with the situation or approaches the goal. Hacket and Betz (1995) extended this approach to career selection decisions. As an example, Hacket (1985) described how higher levels of self-efficacy can lead to "approach" rather than "avoidance" behavior towards major selection among college students. She argued that self-efficacy or confidence not only reflects the ability information but also significantly predicts career choice behavior.

On the other hand, those craft workers who are working in the construction industry are also facing motivational challenges that might influence their decision to keep their career in construction. Early studies in this field indicated that motivational mechanisms were poorly applied among construction workers (Maloney & McFillen 1985, 1986 (a)). These studies recommend construction firms to adopt new approaches such as using positive rewards or enriching jobs rather than traditional approaches which rely more on punishment and discipline (Maloney & McFillen 1986 (a)).

Different studies conducted on motivational factors among construction workers suggest that there is a need to balance extrinsic and intrinsic factors. As an important intrinsic factor, Borcherding & Oglesby (1974) discovered "identification to constructing a unique structure" to have an important effect on the satisfaction of workers, especially at supervisory levels (Borcherding & Oglesby, 1974). Goodrum's (2003)

study examined the factors that affected job satisfaction of U.S. construction worker through the 1970s, 1980s, and 1990s, using the data from the General Sociological Survey (GSS). The results of this study indicated that a sense of accomplishment was the most important driver of job satisfaction. However, this driver is stronger among management occupations and well-educated workers. The second most important motivational factors are extrinsic motivation. High income, followed by chances for advancement, job security, and short working hours are among the extrinsic factors influencing motivation (Goodrum 2003). A research done by Shan and Goodrum (2010) using GSS dataset, provided support for the effect of income on motivation and job satisfaction. The results of this study showed that among different construction workers, those who had higher annual income reported themselves as more satisfied with their job compared to workers with lower income.

Some believe that working in the construction industry demands long working hours and is not supportive of a work-life balance (Djerbarni 1996, Francis et al. 2009, Ling and Ho 2013). Other studies mentioned low professionalism among workers, lack of autonomy and low job securities as other negative aspects of the industry (Ling and Ho 2013, Yng Ling et al. 2015).

It seems that construction firms pay little attention to motivating those who have just entered the industry. In a survey of construction apprentices, the overall motivational scores of participants were recorded as low. The study suggested that construction firms did not offer a variety of rewards to apprentices. They also provided little support for the apprentices to learn better and stay in the trade (Uwakweh 2006).

To remain competitive, construction firms need to adopt more structured human resource development programs in the area of recruiting and retention. They need to see skilled craft workers as their strategic assets (Brandenburg et al. 2006). One antecedent to this paradigm shift is that the industry gains more understanding of the motivational drivers of its current workforce and the future workforce. The goal of this is to describe the factors underlying current craft professionals' decision to continue their careers in

the construction industry and compare them with the factors that influence the young talents' decision to come to the industry. By using the Theory of Planned Behavior, I developed a career decision model for both the future and current workforce.

4.3.2 Theory of Planned Behavior

The Theory of Planned Behavior evolved from the theory of Reasoned Action (Ajzen 1991). In the TPB model, behavior (B) is mainly determined by behavioral intention (BI), which is in turn jointly determined by three conceptually distinct constructs: attitude towards the behavior (AT), subjective norm (SN), and perceived behavioral control (PBC). Meanwhile, Ajzen and Madden (1986) affirmed that PBC may further directly influence behavior. Stated formally in equations:

$$BI = w_1 \times AT + w_2 \times SN + w_3 \times PBC$$

$$B = w_4 \times BI + w_5 \times BPC$$

The Theory of Planned Behavior is visually conceptualized in Figure 9 (Ajzen 1991).

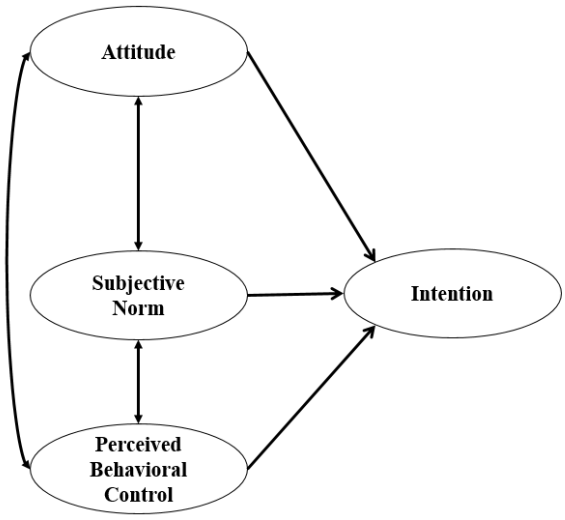


Figure 9: Theory of Planned Behavior

Each determinant of behavioral intention is in turn decomposed into underlying belief structures. Firstly, attitude towards the behavior is equated to individual salient beliefs about the relevant attribute and perceived outcome of performing the behavior (b), multiplied by the subjective evaluation of belief attribute and outcome (e). Positive and negative beliefs are summed to determine the overall attitude of the person towards the behavior; that is,

$$AT = \sum b_i e_i$$

Secondly, SN is formulated as the sum of normative beliefs (nb_j) that salient particular referents believe he or she should perform a specific behavior multiplied by the motivations to comply with those referents (mc_j); that is,

$$SN = \sum nb_j mc_j$$

However, how actors choose social referents depends on their own perceptions and may differ widely, and the extent of compliance depends on the nature of relationship between the referent and the actor and the perceived power of the referent source (Ajzen & Fishbein 1980).

Finally, perceived behavioral control comprises control beliefs and perceived facilitation. The former is the belief that required resources and opportunities are accessible to perform the behavior. The latter is the assessment of the importance of the resources required to perform the behavior successfully. Restated, PBC is the sum of the control beliefs (cb_k) that reflect how an individual perceives the difficulty (or ease) of performing a specific behavior multiplied by the perceived facilitation (pf_k) of the control factors; that is,

$$PBC = \sum cb_k pf_k$$

The utility of the Theory of Planned Behavior is reflected in its recent use across numerous social researches. One of the major advantages of the theory is that it is widely applicable to a variety of behaviors

in different contexts such as health communications, environmental concerns, risk communication, mass transit use, career selection, safety behavior and technology adoption (Ajzen 2011).

Specifically, several studies applied this theory to analyze job search and reemployment behavior (Vinokur & Caplan 1987, Van Hooft et al. 2004 (a), 2004 (b), Song et al. 2006) and career-related decisions (Gelderen et al. 2008, Zellweger et al. 2011, Chen et al. 2016). This theory has also been used in various fields in civil engineering to explain speeding behaviors of drivers in highways and roads (Zhu et al. 2011), pedestrian's unsafe behaviors in urban traffic system (Li et al. 2009), travel mode choice behavior (Zhao 2011), and safety behavior in construction sites (Fang 2016).

The Theory of Planned Behavior is parsimonious and easy to understand (Reynolds 1971). Therefore, it has been used by hundreds of researchers. The more times a theory is employed, the more it is accepted by the scientific community. The Theory of Planned Behavior has been increasingly used in the last decade, with more than 1,000 published studies utilizing the theory (Ajzen 2011).

Armitage and Conner (2004) studied the efficacy of the Theory of Planned Behavior. They looked at 185 independent studies, and discovered the theory could explain the variance in behavior and intention. They also proved the significant amounts of variance in intention and behavior can be explained by perceived behavioral control. Based on their study, the subjective norm was proved a weak predictor of intention (Armitage & Conner 2004).

In summary, the theory’s simplicity, understandability, and applicability of the Theory of Planned Behavior indicate its strength.

4.4 RESEARCH METHODOLOGY

The two main goals of this research are to understand 1) if TBP provides a valid framework to explain the career decision-making model for the future and current workforce in construction, and 2) if there is any difference between the career decision-making models of the future workforce versus current workforce.

To answer the above research questions, I designed a survey instrument on the factors influencing career selection in the construction industry based on TPB. The jobs included in this study are only limited to the construction trades, such as carpenter, electrician, ironworker, painter, pipefitter, and welder. For each element of TPB, attitude, subjective norm, and perceived behavioral control, I found several indicators based on a thorough literature review and discussion within a research team, which included industry experts involved with workforce development in construction. The survey gathered information on demographic background, intention to choose to work in the construction industry, potential factors that influence attitude towards the construction industry, influence of other people important in individual's life (e.g. family, spouse/partner, friends, teachers, and school counselor), and mental factors that might control individual's decision to choose to work in the construction industry. I asked participants 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. Table 1 demonstrates the indicators identified in this research.

The survey and research framework was 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. Both electronic and paper-based questionnaires were prepared and distributed between the months of January and September, 2016. Since the research goal was to apply the TPB on both current workforce and the future workforce and compare their career decision models, the target population included two groups. The first group was young people between the ages of 15 and 24 years (i.e., the age of career selection). For this group, surveys were collected across the country through various efforts such

as recruiting events, participants in formal construction training programs, and career and technical education competitions. These young people comprise the future workforce for the construction industry. A total of 778 responses were collected from different participants across the US. The second group include the current craft workers above the age of 24 years. The surveys were distributed among craft workers who were participating in training programs across different construction companies in U.S. For this group, a total of 641 responses were collected from different participants across the U.S.

Table 13: Career Selection Constructs and Their Indicators

Constructs		Indicators
Intention	I1	Intention indicator 1
	I2	Intention indicator 2
Attitude	A1	Wage
	A2	Job security
	A3	Job opportunities
	A4	Career promotion
	A5	Benefits to society
	A6	Work-life balance
	A7	Working hours
	A8	Career options
	A9	Learning opportunities
	A10	Physical toughness
	A11	Mental toughness
	A12	Respectable career
	A13	Passion for building
Subjective Norm	S1	Family/relatives
	S2	Spouse/partner
	S3	Friends
	S4	School teacher
	S5	School counselor
	S6	Training program instructor
Perceived Behavioral Control	P1	Difficulty of getting certifications
	P2	Knowledge of construction training providers
	P3	Difficulty of getting information about potential careers
	P4	Knowledge of courses needed to become craft professional
	P5	Self-confidence

Totally, 1419 completed questionnaires were received. However, as it will be mentioned in data screening section, 25 cases were removed from the sample.

4.5 DESCRIPTIVE PROFILES OF RESPONDENTS

As discussed earlier, the sample in this study includes two groups: the future workforce and the current workforce. Twenty three percent of the respondents in the first group are between ages of 15 to 17 years old and 77% of them are between ages of 18 to 24. For the second group, 36% are from Generation Y (born 1977 to 1995), 49% are from Generation X (born 1965 to 1976), and 16% from Baby boomers (born 1946 to 1964). Table 15 illustrates the profiles of respondents in our sample based on gender, ethnicity, and number of years of work experience in construction-related jobs.

Table 14: Profiles of Respondents

		Future Workforce n = 765	Current Workforce n = 629
Gender			
	Males	87%	88%
	Females	11%	11%
	Not Identified	2%	1%
Ethnicity			
	White/Caucasian	71%	65%
	Hispanic/Latino	16%	15%
	African American	8%	12%
	Other	5%	8%
Work Experience in Construction-Related Jobs			
	No Work Experience	26%	0%
	Less than 1 Year	24%	5%
	1-2 Years	17%	8%
	2-5 Years	26%	18%
	More than 5 Years	7%	69%

4.6 STRUCTURAL EQUATION MODELING

This research applies the SEM technique to test the hypothesis if the theory of planned behavior can explain the career selection decision-making model of the future and current workforce. SEM allows researchers to simultaneously assess multiple indicators for each construct and estimate multiple dependence relationships among constructs to address the research questions (Hair et al. 2014).

To conduct SEM, the researcher needs to start with a measurement model. The measurement model specifies the indicators for each construct and enables an assessment of construct validity (Hair et al. 2014). In this step, several statistical techniques including Exploratory Factor Analyses (EFA) and Confirmatory Factor Analysis (CFA) are used to ensure the reliability and validity of the measurement model (Kline 2010, Schumacker & Lomax 2012, Hair et al. 2014). EFA is usually conducted to distinguish the main measures and their constructs, which helps us to confirm the structure of career selection model. On the other hand, CFA is applied to test the validity of the identified measurement model (Schumacker & Lomax 2012, Hair et al. 2014). The structural model represents the causal relationships between the constructs. In this study, the hypothesized relationships between constructs are justified by the Theory of Planned Behavior. The structural model is specified and tested with structural equation modeling.

SEM has several advantages over other multivariate data analysis techniques. It provides an enhanced understanding of the complex relationships that exist among theoretical constructs, allows simultaneous analysis of direct and indirect effects with multiple exogenous and endogenous variables, and assumes the measurement error in the model's observed variables, which improves the validity and reliability of a study (Stage et al., 2004, Kline 2010, Schumacker & Lomax 2012, Hair et al. 2014). SEM can also be employed to compare alternative theoretical models in order to assess the relative fit of each model (Skosireva 2010).

4.7 DATA ANALYSIS

Figure 10 illustrates the procedure I adopted to analyze the data. The first step is to prepare data for SEM. In second step, I developed SEM for both future and current workforce through three procedural steps of multivariate analysis: principal component factor analysis (PCFA), confirmatory factor analysis (CFA), and structural equation modeling. A similar process was applied in developing SEMs for the success traits for construction projects (Tabish and Jha 2012), building Information modeling maturity (Chen et al. 2016), buyer power and supplier relationship commitment (Chei et al. 2017), and the factors affecting construction labor productivity (Durdyev et al. 2018).

The last section of data analysis examines the hypothesis whether the SEM for the two groups are statistically significant using multi-sample SEM approach. This approach has been used by several researches (Talaja 2012, Babayiğit, 2014, and Zhang et al. 2014). Each analysis will be explained in more detail in the following sections.

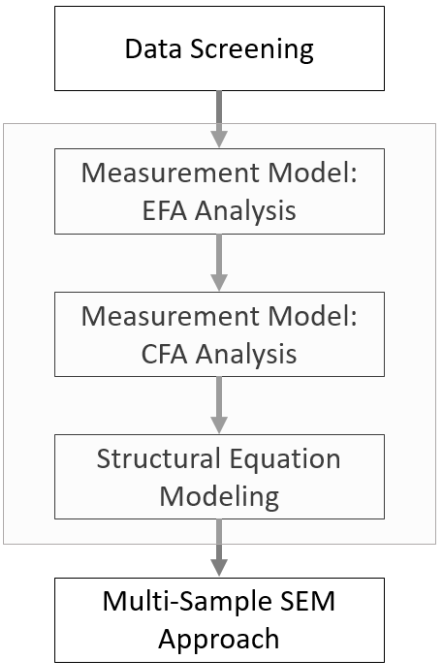


Figure 10: Data Analysis Procedure

4.7.1 Data Screening

To conduct SEM, the original data should be screened for possible problems (Kline 2010, Hair et al. 2014). The first step is to make sure that there is no missing value in the data set. The second step is to examine the assumption of normality. The univariate normality is tested in terms of skewness index (SI) and kurtosis index (KI). For future workforce sample, the SI ranges between −1.234 and 0.706. For current workforce sample, the SI ranges between −1.205 and 0.685. So, the absolute values of SI are less than the recommended value of 3 (Kline 2010). The KI for the future workforce sample is between −2.214 and 0.735 and for the current workforce is between – 1.128 and 0.826. According to Kline (2010), values of kurtosis within ±10 are acceptable. Therefore, the normality assumption for all indicators cannot be rejected. Multivariate normality was also evaluated using Mahalanobis distance (Hair et al. 2014). It resulted in removing 25 cases from the original data set. In the final step, bivariate correlation and the variance inflation factor (VIF) were used to detect Multicollinearity. VIF above 10 indicates Multicollinearity problem (O'Brien 2007). The analysis showed no indication of Multicollinearity in the data set.

4.7.2 Measurement Model of Career Selection: EFA Analysis

To confirm that there are four constructs in career selection model, EFA was conducted using the whole dataset. Kaiser-Meyer-Olkin (KMO) test was above 0.8 level, which means the sampling is adequate for factor analysis. The Bartlett test of sphericity was 4,994.231 (p-value < 0.000). This means at least two of variables are strongly correlated, which confirms that factor analysis can be used to analyze the data. EFA was conducted using SPSS. Varimax method was adopted to rotate principal component matrix. Indicators with factor loadings less than 0.45 (cut-off for significance) were found to be weak indicators of the constructs and therefore were removed (Hair et al. 2014). Two items excluded from the data according to their loadings are difficulty of getting certifications (P1) and difficulty of getting information about potential careers (P3). Note that identified four constructs explain 61.273% of the total variance. Cronbach's alpha coefficient was also calculated to verify individual construct reliability and compared to satisfactory

level, which is 0.7 (Lance et al. 2006). The results indicate the constructs in our study are internally consistent. Table 15 summarized the factorial structure and its related statistics.

Table 15: EFA Results

Constructs	Indicators	Factor Loading	Cronbach's alpha
Intention	Intention indicator 1	0.766	0.926
	Intention indicator 2	0.788	
Attitude	Wage	0.780	0.765
	Job security	0.575	
	Job opportunities	0.637	
	Career promotion	0.746	
	Benefits to society	0.747	
	Work-life balance	0.669	
	Working hours	0.659	
	Career options	0.759	
	Learning opportunities	0.791	
	Physical toughness	-0.712	
	Mental toughness	0.768	
	Respectable career	0.720	
	Passion for building	0.706	
Subjective Norm	Family/relatives	0.778	0.911
	Spouse/partner	0.800	
	Friends	0.816	
	School teacher	0.828	
	School counselor	0.836	
	Training program instructor	0.816	
Perceived Behavioral Control	Knowledge of construction training providers	0.753	0.712
	Knowledge of courses needed to become craft professional	0.767	
	Self-confidence	0.828	

4.7.3 Measurement Model of Career Selection: CFA Analysis

So far, I showed that there are four constructs in the measurement model. In this section, we need to validate the measurement model using convergent validity and discriminant validity (Kline 2010). Convergent validity indicates how well indicators load up on the constructs. Discriminant validity shows that different constructs are actually measuring different things.

To evaluate convergent validity, I did CFA analysis by examining the factor loading of each item. The baseline measurement model can be modified by elimination of links with very low correlations or removal of the indicators showing low correlations with their constructs (Kline 2010). There are several numbers of goodness-of-fit (GOF) indices, which evaluate how well the measurement model with estimated covariance reproduces the observed covariance matrix among the indicators (Hair et al. 2014). The fit indices can be classified into several classes. However, it is recommended researchers utilize a range of fit indices instead of relying on one index (Marsh et al. 1996). Based on literature, a model is regarded as acceptable if the normed chi-square < 3.00, goodness of-fit index (GFI) > 0.95, root mean square error of approximation RMSEA < 0.07, the incremental measure of comparative fit index CFI > 0.95, and parsimony fit measure of adjusted goodness-of-fit index AGFI > 0.9 (Steiger 2007, Kline 2010, Schumacker & Lomax 2012, Hair et al. 2014).

The measurement model was analyzed using AMOS. After four trials, five indicators removed, which led to a model with the recommended level of the GOF measures for the whole sample (normed chi-square = 2.419, GFI = 0.977, RMSEA = 0.054, CFI = 0.967, and AGFI = 0.948). These five indicators include job opportunities (A3), work-life balance (A6), working hours (A7), physical toughness (A10), and support from training program instructor (S6).

In addition, the composite reliability (CR) and the average variance extracted (AVE) value for each construct were calculated (Table 16). CR greater than 0.7, AVE greater than 0.5, and CR of each construct greater than AVE for the construct provide evidence for convergent validity (Fornell & Larcker

1981). Regarding discriminant validity, our calculation showed that the squared correlations between any two constructs were smaller than AVE scores of those constructs (Fornell & Larcker 1981).

Table 16: Measures of Validity

Constructs	CR	AVE
Intention	0.753	0.604
Attitude	0.906	0.515
Subjective Norm	0.921	0.660
Perceived Behavioral Control	0.826	0.614

Therefore, the results of this section prove that the constructs in our measurement model do have convergent and discriminant validity. Figure 11 shows the baseline measurement model resulted from analysis of this section.

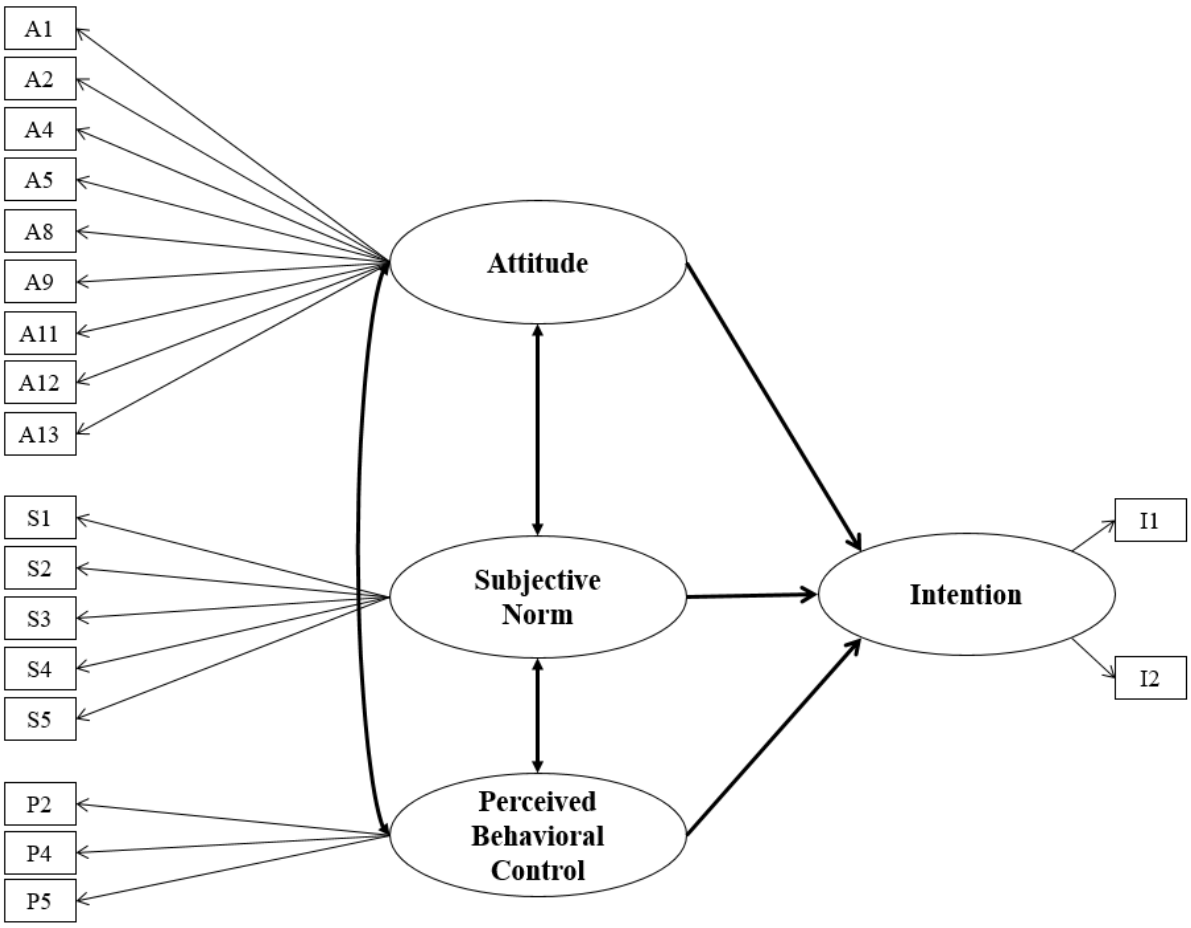


Figure 11: The Baseline Measurement Model

4.7.4 Structural Equation Model of Career Selection

As mentioned earlier, the causal relationships between constructs are hypothesized based on the Theory of Planned Behavior. Prior to conducting multi-sample analyses, SEM with Maximum Likelihood estimation technique was employed for each sample separately. It is required that before conducting a multi-sample SEM analysis, the model fit on the data is confirmed separately for each sample (Kline 2011,

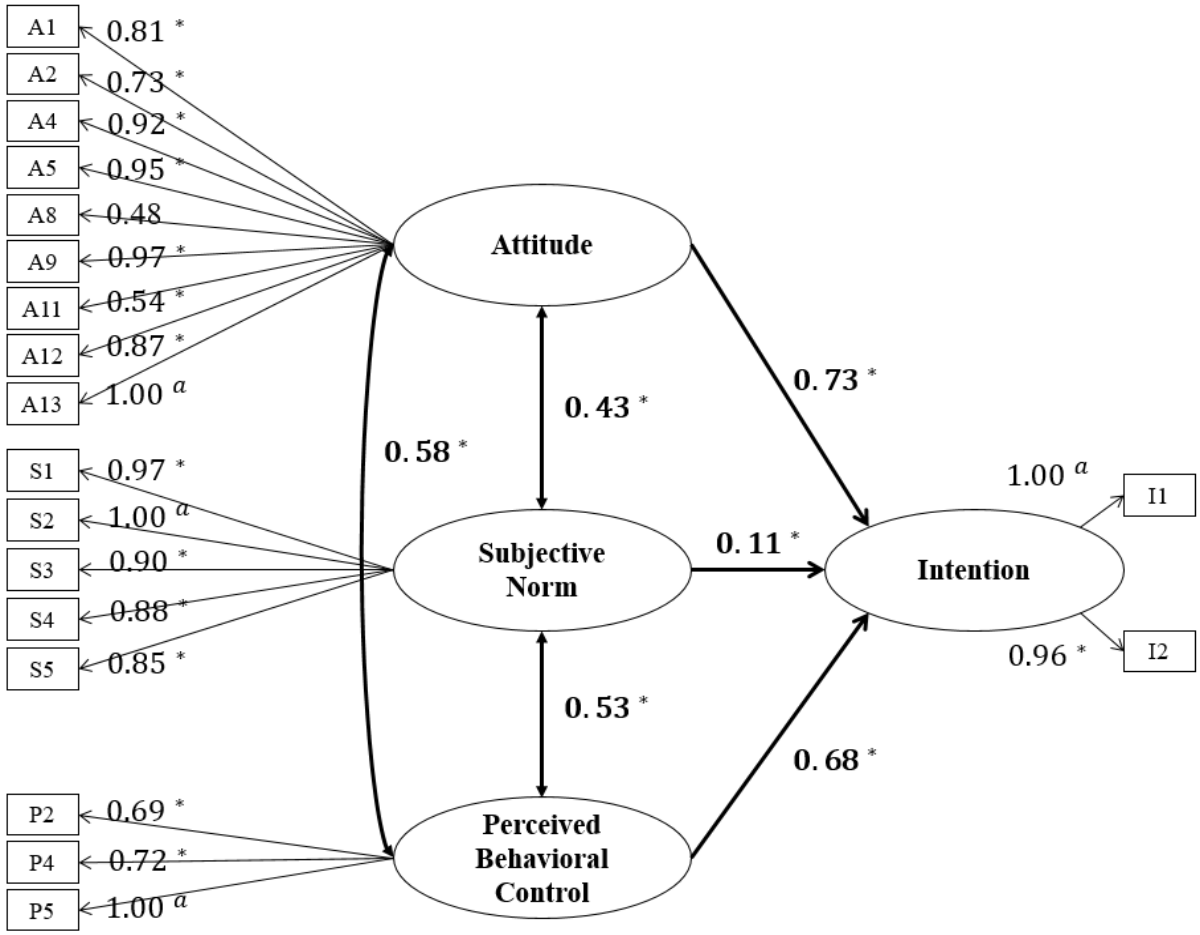
Schumacker & Lomax 2012, Tabachnik & Fidell 2013). The results of this analysis indicate the career selection model yielded very good fit indices for both samples.

Figure 12 illustrates the unstandardized path coefficients of SEM for future workforce sample. Overall, the model accounted for considerable variance in young talents' intention to choose a career in the construction industry (R-square = 0.647). The model adequacy is supported by normed chi-square = 2.541, GFI = 0.956, RMSEA = 0.044, CFI = 0.963, and AGFI = 0.913. The results proved that attitude, social norm and perceived behavioral control have statistically significant impact on intention (p-value <0.000). Note that in this model, all standard errors lie between -0.625 and 0.964, which are considered appropriate since no standard error is excessively large or small (Byrne 2009).

To conduct SEM, it is important to note that the regression weight of one of the indicators in each construct was fixed to be one in order to scale the factors, which acted as a reference indicator measure. Hence, the reference indicator measures were not estimated (Hair et al. 2014).

The results of SEM for future workforce sample proved that TPB can explain factors underlying career decision-making process. For the future workforce, attitude has the highest impact on intention (beta = 0.73) but perceived behavioral control also has high effect on intention (beta = 0.68). Although the effect of subjective norm on intention is statistically significant, the effect size is not as large as other constructs (beta = 0.11). Among attitudinal factors, top four factors include passion for building (A13), benefit for society (A5), learning opportunities (A9) and career promotion (A4). For young talents, it is also important to have a respectful career (A12). It is interesting that young talents prefer to have a job that demands mental challenges (A11). Traditional aspects of a job including wages (A1) and job security (A2) are still important for young people, but their weights are not as large as more intrinsic factors such as passion for building, providing benefit for society, and experiencing learning opportunities. Note that career options (A8) has not statistically significant impact on attitude. Regarding subjective norm, the results also show that partner/spouse (S2), parents (S1), and friends (S3) have the highest influence on the individual. In

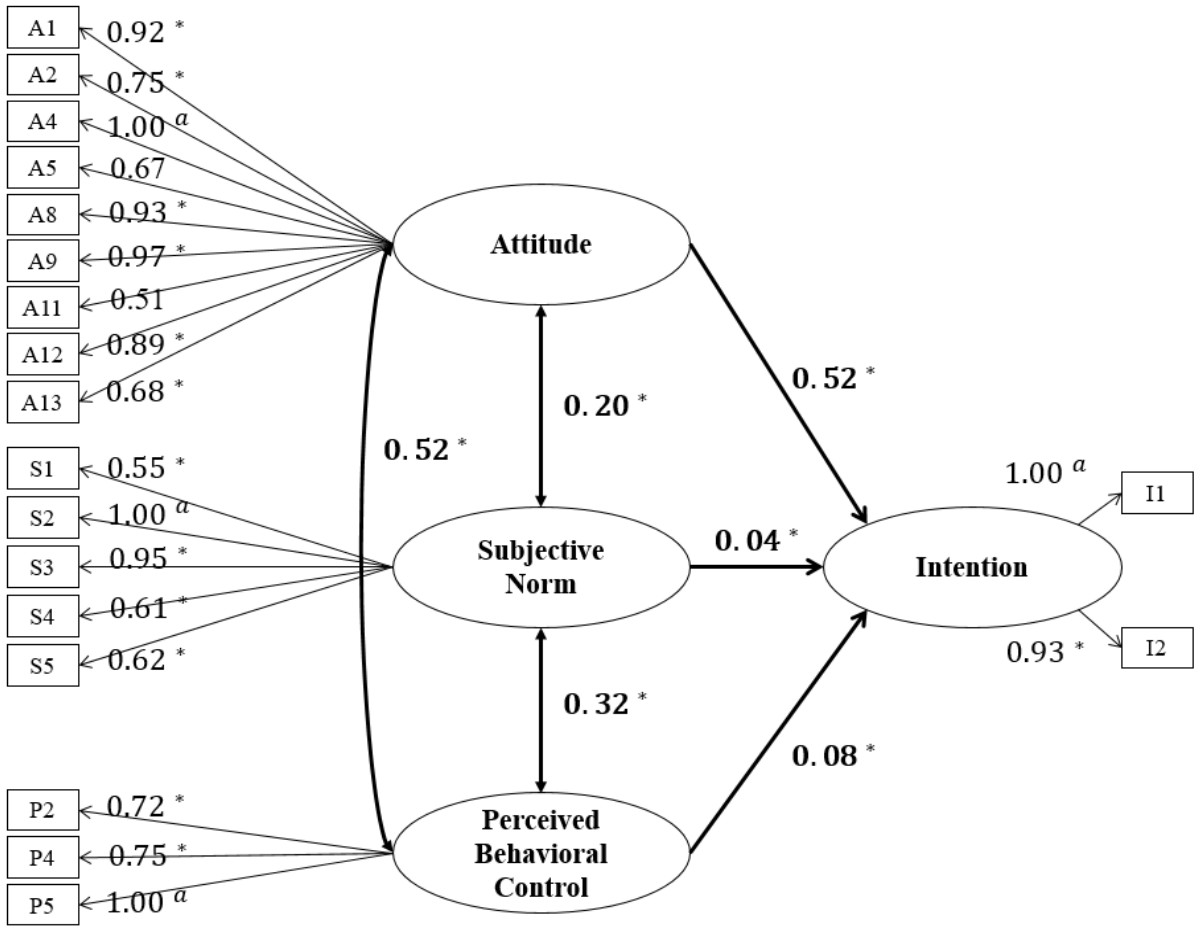
accordance with literature, it is proved that confidence in the individual's ability to become a successful craft professional (P5) has the highest influence on the perceived behavioral control construct. However, lack of information about training providers in construction trades (P2) and lack of knowledge about educational requirements to become a craft professional (P4) are important barriers. This is in accordance with the intuition of experts in our research team who believes that many young people do not have enough information about the career path to become a skilled trade worker.



** p-value < 0.05, a: Reference indicator (not estimated)*

Figure 12: Structural Equation Modeling With Unstandardized Coefficients for Future Workforce Sample

Figure 13 illustrates the unstandardized path coefficients of SEM for current workforce sample. As shown in Figure 13, for current workforce the attitude is the most significant factor (p-value <0.000). The next important factors are perceived behavioral control and social norm (p-value <0.000). SEM analysis for current workforce indicates that the hypothesized model accounted for 58.1% variance of intention. GOF measures include normed chi-square = 3.473, GFI = 0.951, RMSEA = 0.051, CFI = 0.952, and AGFI = 0.904. Four out of five indices prove that the model fit for current workforce sample is acceptable (Hair et al. 2014). All standard errors range between -0.808 and 1.094.



** p-value < 0.05, a: Reference indicator (not estimated)*

Figure 13: Structural Equation Modeling With Unstandardized Coefficients for Current Workforce Sample

Again, I proved that TBP can explain the intention to keep a career in the construction industry for the current craft workforce very well. For this sample, attitude has the highest impact on intention (beta = 0.52). Although perceived behavioral control and subjective norm have statistically significant impact on intention, their effect size makes them less important. For attitude, I can see traditional factors have the highest weight. Top four attitudinal factors include career promotion (A4), learning opportunities (A9), career options (A8) and wages (A1). For the current workforce, it is important to have a respectful career by working in the industry (A12). Job security (A2) also has impact on attitude. Passion for building (A13) for this group is still a driver for attitude but not as important as for the future workforce. Unlike the future workforce sample, benefit to society (A5) and mental toughness (A11) has no statistically significant impact on the current workforce attitude. Regarding their subjective norms, partner/spouse (S2) and friends (S3) have the highest influence on the individual. Similar to future workforce sample, confidence (P5) has the highest influence on the perceived behavioral control construct, although this construct does not have the same effect for the current workforce sample at all.

4.7.5 Multi-Sample SEM Approach

The results of the previous section provide evidence that there exist differences in SEM models between current and future workforce. To statistically prove this hypothesis, I used a multi-sample SEM approach. In multi-sample SEM, several groups are analyzed at the same time, providing the ability to simultaneously test a theoretical model for its applicability to different groups and to identify the differences in the parameters between the groups (Byrne 2009).

Conducting multi-sample SEM has several steps. First, the joint unconstrained model for all groups is estimated. In this step, coefficients are allowed to vary freely across groups. In an unconstrained model, structural relationships are specified in both groups meaning that the model is equal across groups, but the coefficients in the relationships are estimated independently for each group. In this step, error variances, and variances and co-variances of the latent variables (constructs) are not constrained to be equal

(Schumacker & Lomax 2012, Tabachnik & Fidell 2013). In the previous section, I reported the results of career selection model for each sample.

The next step is an estimation of a joined constrained model where the parameters across groups were constrained to be equal to each other. In the estimation of the constrained model, factorial structure and structural paths are the same across groups. However, the constraints should be incrementally placed in the model: at the first step, factor loading are constrained; second, factor loadings and error variance are constrained; third, factor loadings, error variance, and structural regression coefficients are constrained; and finally factor loadings, error variance, structural regression coefficients, and factor variance are constrained (Tabachnik & Fidell 2013). When parameters are constrained, they are forced to be equal to one another. After each set of constraints is added, a chi-square difference test is performed for each group between the less restrictive and more restrictive model (Schumacker & Lomax 2012, Tabachnik & Fidell 2013).

Table 18 shows a summary of the model fit indices of the invariance tests. In the first step, I conducted the test of invariance of the unconstrained model to establish if the overall model explains the combined data from the two samples. The unconstrained model on the pooled data across two samples yielded good model fit indices, normed chi-square = 2.479, GFI = 0.951, RMSEA = 0.047, CFI = 0.961, and AGFI = 0.923. Second, the invariance of factor loadings was tested by placing constraints on factor loadings with both samples. This means constraining all factor loadings across two samples to be equal. As indicated in Table 5, the second model deteriorated by applying this constraint. The chi-square difference test shows that the model 2 is significantly lowered by additional constraints (p-value <0.000). In Model 3, we added more constraints by forcing factor loadings and error variances across the samples to be equal. The results of chi-square difference test indicates there is no significant disparity between model 2 and model 3 (p-value =0.993). In model 4, I took another step to test the invariance of the factor loadings, error variances, and structural regression coefficients by constraining all these parameters across both samples. Again, the model deteriorated by adding this constraints relative to the previous model (p-value =0.01). In

the final step, all constrains were placed on the model. The statistical test indicated no significant difference between model 5 and model 4 (p-value = 0.781).

The results of multi-sample SEM analysis confirmed that although the constructs recommended by Theory of the Planned Behavior can explain the intention to choose a career in construction, the relative importance of the constructs and their constituent factors are not the same. In next section, we will discuss the results.

Table 17: Multi-Sample Invariance Tests and Chi-Square Difference Test Results

Model	Fit Indices for the Model				Chi-Square Difference Test Results		
	Chi-square	df	CFI	RMSE	ΔChi-square	Δdf	Significance
1-No equality constraints	312.295	126	0.961	0.047			
2-Factor loadings equal	403.207	142	0.948	0.091	90.912	16	Yes
3-Factor loadings and error variance equal	408.341	161	0.944	0.089	5.134	19	No
4-Factor loadings, error variance, and structural regression coefficients equal	429.783	164	0.851	0.098	21.442	3	Yes
5-Factor loadings, error variance, structural regression coefficients, and factor variance equal	431.536	168	0.850	0.093	1.753	4	No

RMSEA= Root mean square error, CFI= Comparative fit index, df = Degree of freedom

4.8 CONCLUSION

Several studies documented skilled craft workers shortages in the construction industry. On one hand, younger people are not so much eager to enter the industry and work in technical occupations. On the other hand, some skilled workers exit the industry to other industries. The goal of this study was to investigate the career decision-making process for both future and current workforce.

Our data analysis proved that the Theory of Planned Behavior could explain considerable amount of variance in intention for both groups. The results indicated that attitude and perceived behavioral control have a high impact on the intention to choose a career in construction for future workforce sample. Interestingly, their top four factors are passion for building, benefit for society, learning opportunities and

career promotion, which shape the attitude towards working in construction as a craft professional. For perceived behavioral control, confidence to become a successful craft professional is the most important factor.

For the current workforce, attitude has the highest effect on the individual's intention to continue pursuing a career the in construction industry. However, the subjective norm and perceived behavioral control have low effect on intention. For this group, traditional factors such as career promotion, wages and career options have the highest impact. Although, finding learning opportunities is still among the top four attitudinal factors.

In addition, by using the multi-sample SEM, I proved that the difference between two models are statistically significant. As far as the authors know, this is the first career decision model for construction craft workers and the results of this study can help construction companies and the industry to improve their recruitment and retention policies and practices.

The recruitment and retention of a future and current workforce are two significant parts of workforce development. Obviously, training and job placement are critical parts too. These findings show that industry outreach efforts to recruit versus retain should be different. Many industry recruitment materials (e.g. videos and brochures) emphases high wages and career advancement as justifications why individuals should pursue a construction job. These factors are important, but these factors are most important to **retain** the current workforce rather than to **recruit** a new workforce. By their nature, recruitment materials should be tailored to the future workforce, which as this study observes should emphasize the passion for building, opportunities to benefit society (e.g. renewal of our nation's infrastructure system), learning opportunities, as well as career advancement.

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5 INVESTIGATING POLICIES TO IMPROVE THE U.S. WORKFORCE DEVELOPMENT SYSTEM

5.1 ABSTRACT

The United States' workforce development system is in need of expansion and renewal. As a system, workforce development includes the recruitment, training, placement and retention of individuals in gainful employment opportunities. Over the past three decades, workforce shortage has been emerged in construction. The shortage has worsened to the point that it is not only hard to find quality craft workers, but the shortage is affecting projects' schedule, cost, and safety.

One of the goals of this study is to investigate the U.S. workforce development system at macro level and try to understand what factors contribute to the outputs of the system. Another main goal of this research is to recommend policies that help renew the U.S. workforce development system and overcome the challenges. To achieve this goal, a panel of industry experts involved with workforce development helped the research team to investigate strengthens and weaknesses of the system. Intensive literature review and archival data analysis helped the research team to gain more in-depth understanding the situation. Through several panel discussions and using Analytical Hierarchy Process (AHP) methodology, the research team identified and prioritized potential policies to overcome these challenges. The main contribution of this research is that the results of this research could outline the major steps to initiate the path to make the U.S. workforce development system a global example.

5.2 INTRODUCTION

Construction is one of the largest sectors in the United States. In 2016, the construction industry accounted for 4.25 percent of the U.S. GDP. The industry has seen a steady growth in terms of its contribution to the U.S. GDP since 2011 (Bureau of Economic Analysis 2017). It employed approximately 7 million people in 2017 (Bureau of Labor Statistics 2017).

However, the construction industry currently faces several challenges in areas of workforce development that can to hamper its sustainability and growth. Over the past three decades, several studies

have documented shortage of skilled craft workers in construction (Business Round Table 1997, Construction Users Round Table 2001, McGraw-Hill Construction 2012, Construction Industry Institute 2015). More recently, the Associated General Contractors of America's (AGC) survey across 26,000 construction firms in 2017 reported that growing workforce shortages in construction have made it difficult to find qualified workers. The participants in the survey expected the workforce shortage would continue to be a challenge in the near future. Vereen (2013) quantitatively illustrated that the construction industry needs to increase the current skilled workforce pool by 1.3 to 3 million workers by 2022. Some studies also found that the shortage has worsened to the level that it is not only hard to find qualified craft workers, but also negatively impacting projects' schedule, cost, and safety (Karimi et al. 2016, 2017, 2018).

On the other hand, the average age of craft professionals within the industry is increasing. The average age of the U.S. construction craft workers is increasing four times faster than all other industries during the last decade (Construction Industry Institute 2015). Part of this problem is because younger people are not so much eager to enter the industry and work in technical occupations. McGraw-Hill Construction (2012) reported that 62% of trade firms that participated in its survey believed that their trades were not attractive to the younger generation.

However, this phenomenon is not limited to the construction industry and is a part of a broader challenge in workforce development system in the U.S. As many as 2 million future jobs in manufacturing sector in U.S. could become unfilled from the lack of workers with the right skills and knowledge (Giffi et al. 2015). The study indicated that the skill gap is due to movement of experienced workers, a negative image of the manufacturing industry among younger generations, lack of STEM (science, technology, engineering and mathematics) skills among workers, and a gradual decline of technical education programs in public high schools (Giffi et al. 2015). In spite of critical role of Career and Technical Education (CTE) in helping many youth understand the career path of working in industries like construction, the opportunities for high school students to take a CTE course has greatly diminished with more resources being allocated to college preparation based courses (Construction Industry Institute 2015).

The U.S construction industry's challenge to find enough qualified craft workers reflects a widespread challenge that all other industries relying on CTE-based workforce have. The common assumption is that that most adults with a postsecondary degree typically earn more than adults with only a high school diploma do. Based on this assumption, most policies encourage the pursuit of a 4-year college degree. A study conducted by Carnevale et al. (2013) indicated that adults with some postsecondary education or an associate's degree earn approximately 20 percent more than adults with a high school diploma do, while adults a bachelor's degree earn almost twice as much. Furthermore, projected job growth for occupation requiring only a high school degree is falling, while jobs requiring some postsecondary education are projected to increase (Carnevale et al. 2013). In addition to the economic benefits, other studies have shown that individuals with a college degree also enjoy better job benefits (e.g. health coverage, retirement, and paid vacation), greater job satisfaction, healthier lifestyles, and greater social mobility (Ma et al 2016). However, the question remains if the increase in number of individuals pursuing 4-year college degrees is sustainable. In year 2017, student loan debt in the U.S. was approximately $1.3 trillion and forecasted to reach $2.5 trillion by 2025 (Friedman 2017). Only household debt due to home mortgages currently exceeds college debt (Dynarski 2015). Furthermore, college debt is increasingly affecting not only the student but also their parents who are paying off their children's student loans (Ashford 2016). Because of increasing student debt and forecasts of increasing cost of college education in U.S. universities, the college debt burden has been described as the next financial crisis set to affect the U.S. (Foroohar 2017, Rogers and Baum 2017).

There is no doubt that all individuals need postsecondary education. Nevertheless, there are other forms of postsecondary education that might suit young people needs and wants. They can also receive an increase in income by completing a CTE program. As an example, one in four workers with licenses and certificates earn more than the average employee with a bachelor's degree as do three in ten workers with an associate's degree (Carnevale et al 2010). More interestingly, it is estimated that the U.S. industry

typically requires 30% of the workforce with a university degree (including a bachelor or graduate degree) and the remaining 70% possess some form of CTE certification (Gray & Herr 2006).

As a system, the role of workforce development is to the recruit, train, employ and retain individuals in valuable employment opportunities. It is also in a dynamic relationship with other society subsystems such as economy (Hodge 2007). However, evidences mentioned above show that there is misfit between the workforce development system and the U.S. economy.

One of the goals of this study is to investigate the U.S. workforce development system at macro level and try to understand what factors contribute to the outputs of the system. Another main goal of this research is to recommend policies that help renew the U.S. workforce development system and overcome the challenges.

To achieve this goal, a panel of industry experts involved with workforce development helped the research team to investigate strengthens and weaknesses of the system. Intensive literature review and archival data analysis helped the research team to gain more in-depth understanding the situation. Through several panel discussions, the research team investigated aspects of the challenges facing the workforce development system and identified a series of potential policies to overcome these challenges. The justification for these policy recommendations and deeper explanation about what they mean are discussed in section 4. Analytical Hierarchy Mythology (AHP), which is a method for multi-criteria decision-making, has been applied to thoroughly evaluate these policies considering their relative benefits and costs. Finally, the policies have been organized among those that can be implemented in the short-term (less than three years) and those that will require a longer-term effort to implement.

Although, any effort to meaningfully change the system will require the business leaders within the construction industry and other industries, communities, and governmental agencies to work together, the authors are hopeful that the results of this research could outline the major steps to initiate the path to make the U.S. workforce development system a global example.

5.3 RESEARCH METHOD

As discussed earlier, the goal of this research is to recommend policies that transform the U.S. workforce development system into a world leader. To develop and prioritize policy recommendations, the research team followed the process illustrated in Figure 14.

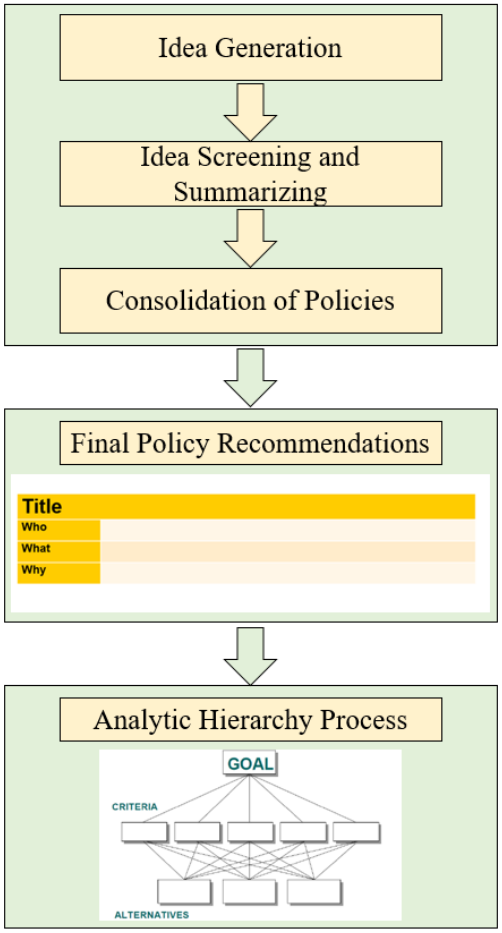


Figure 14: Overall Process of Development and Weighting of Policy Recommendations

Phase 1 includes idea generation, idea screening, and consolidation of policies. Our research team, which included 13 industry experts involved with workforce development in construction held four meetings during the period from April to September 2017 to generate ideas about possible solutions to achieve the goal. At the same time, a thorough literature review and archival data analysis in the areas of interest was conducted and the results were presented to the experts in our research team. This helped the

research team achieve better understanding of the U.S. workforce development system and its strengths and weaknesses. In this process 32 ideas regarding policies were formed. In idea screening phase, research team tried to reduce the number of policies. Since some ideas had some overlap and could be integrated together, the research team put them into single category in order to develop policies that are independent from each other. Again, the results were discussed in our team. Finally, eight policies were consolidated. It is noteworthy to mention that in consolidation phase all final policies were discussed based on the details of each policy (what), the rationale behind it (why), and the audience of it (who).

To evaluate and prioritize policy recommendations, Analytical Hierarchy Process (AHP) methodology as applied. AHP is one of the most widely used multi-criteria decision making techniques introduced by Thomas Saaty (1980). To implement AHP methodology, three major steps should be taken:

- The first step is to decompose the problem into elements and each element is further decomposed into sub-elements until the lowest level of the hierarchy.
- The second step is to compare the relative importance of each element by doing pairwise comparison. In this step, decision makers provide numerical values for the priority of each element using a rating scale. If quantitative ratings are not available, decision makers still can provide the ratings using subjective comparison (e.g. A is more important than B).
- The third step is to compute the priorities of elements at each level using eigenvector or least square analysis and repeat the process for each level of the hierarchy until overall weights for alternatives calculated (Saaty 1980, 1994).

AHP has been successfully applied in different domains such as economics, public policy, education, marketing, and medicine (Saaty 1990, 1994). Several advantages of AHP convinced the research team to use this approach. First, the research team faced with a problem, which was complex with multiple conflicting and subjective criteria. AHP methodology can help decision maker to deal with complex decisions by decomposing them into more manageable elements, and then combining the results (Saaty

1994). Second, it allows the decision maker to compare the alternatives relative to some criteria. One of the AHP's strengths is to allow the decision maker to capture objective aspects as well as subjective ones (Ishizaka & Labib 2011). Since the decision in this research was complex, all alternatives were subjectively evaluated relative to criteria by the experts. Explaining the subjective evaluation using verbal and graphical responses can also be applied in AHP which makes it more intuitively appealing and user-friendly (Ishizaka & Labib 2011). Third, AHP provides a useful index to check the consistency of the decision maker's evaluations, thus it helps reduce the bias in the decision making process (Saaty 1980). Forth, AHP is particularly suitable for group decision making and allows combining the individuals' preferences into a consensus rating of the group (Saaty & Peniwati 2013).

To decompose the decision problem into its constituent elements, the research team structured the problem into four levels: goal, criteria, sub-criteria, and policy options. The hierarchy structure of the decision model is illustrated in Figure 15. As mentioned earlier, the goal set for the decision is to recommend policies which make the U.S. workforce development system the best in the world. AHP methodology allows to structure the decision in a way to do Benefit/Cost & Risk analysis which is very useful to think about the problem (Mu & Pereyra-Rojas 2017). At criteria level, the model has benefits and cost/risk clusters. Literature review and brainstorming helped the team identify several sub-criteria in each cluster. Kraft and Furlong (2012) suggested that to evaluate public policy proposals eight criteria should be considered: effectiveness, efficiency, equity, liberty/freedom, political feasibility, social acceptability, administrative feasibility, and technical feasibility. Chambers & Wedel (2005) proposed stigmatization, target efficiency, trade-offs, and sustainability. Considering the context of the decision, the research team decided to consider total of seven sub-criteria to evaluate policies. The definition of these sub-criteria is described below:

- Benefits:
    - Effectiveness: the capability to produce a desired solution to the goal.

- Sustainability: the Decision should not actually add negative impacts or limit the capability of other parts of the system.
- Flexibility: The ability of policy to cope with possible changes in socio-economic conditions.

- Costs/Risks
  - Cost effectiveness: the cost of designing, implementing and maintaining an adaption action.
  - Social acceptability: the extent to which the public will accept and support a policy proposal.
  - Political feasibility: the extent to which elected officials accept and support a policy proposal.
  - Administrative feasibility: the likelihood that a department or agency can implement the policy well.

For alternatives, the justification of policies and deeper explanation about what they mean are detailed in the following section.

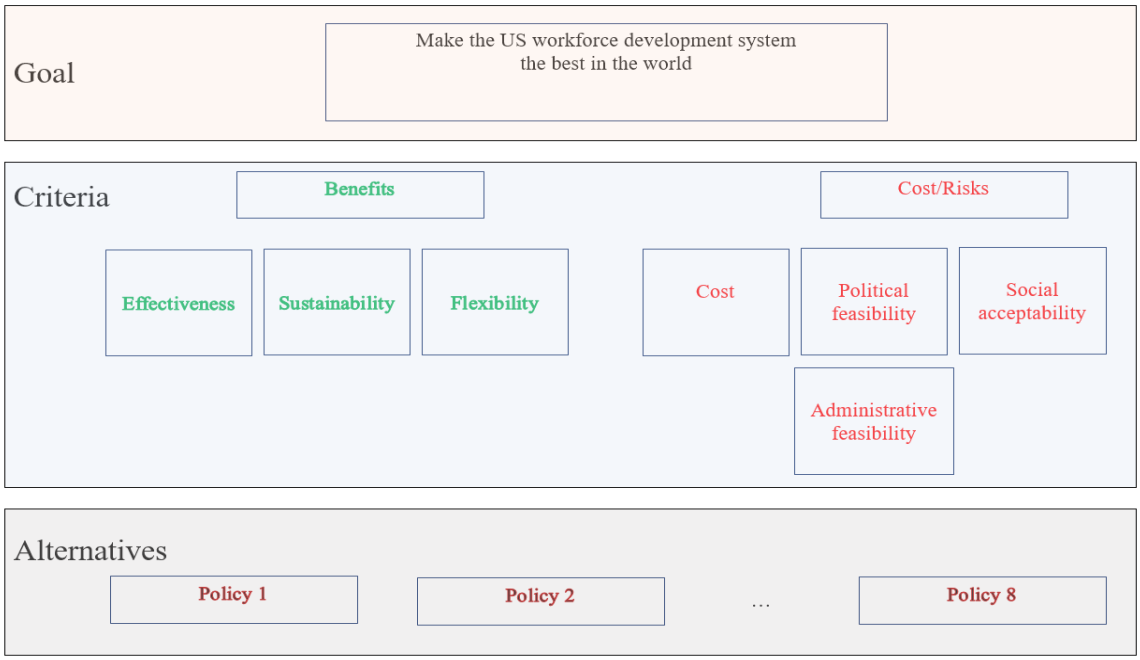


Figure 15: AHP Model

5.4 POLICY RECOMMENDATIONS

This section explains the details and justifications for the eight policies as alternatives in the AHP model.

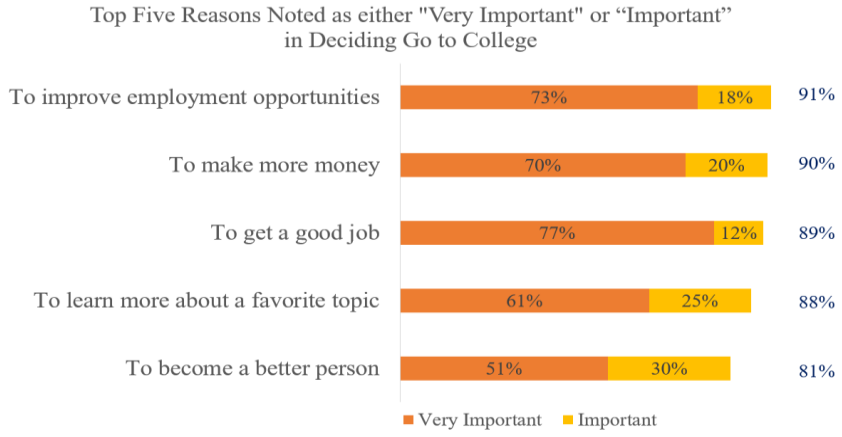
5.4.1 Policy 1: Establish and Strengthen the Awareness of Career Opportunities in The U.S.

Why:

A poll conducted by the Robert Wood Johnson Foundation and the Harvard T.H. Chan School for Public Health (2015) found that 26% of parents whose children played high school athletics hoped their child would play professional sports. For families with household incomes less than $50,000/year, the number is 39%. Reality is far different. The National Collegiate Athletic Association (2017) estimates that the probability of a male high school athlete participating in the NCAA (across all divisions) in basketball is 3.4% and football is 6.8%. Of these selected few student athletes, only 1.1% will go on to play professional basketball and 1.5% will go on to play professional football (National Collegiate Athletic

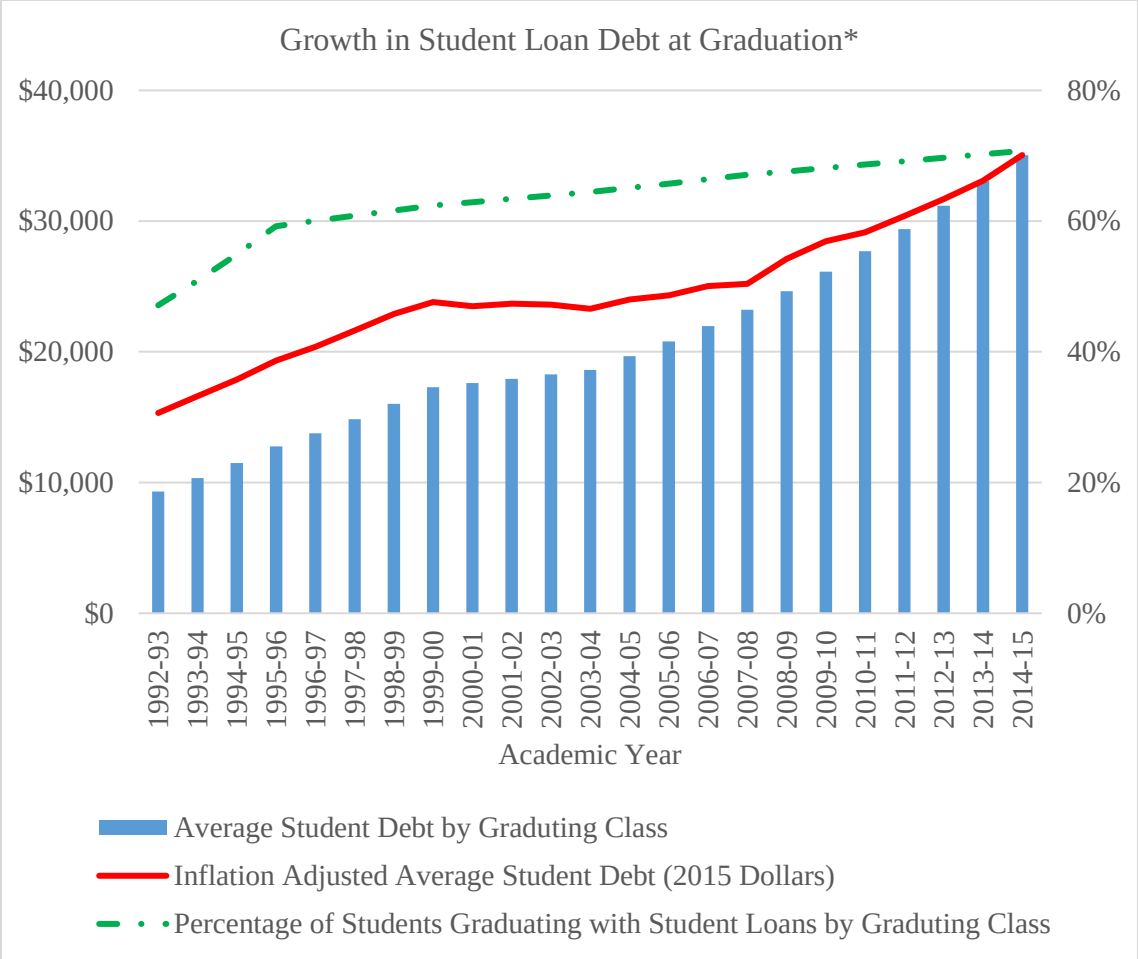
Association 2017). Clearly, professional sports are not a suitable career choice for the vast majority of high school students.

Although the low probability of success in professional sports may seem reasonable to some extent, the chance of success after college graduation is relatively low as well. Eighty percent of young people at the age 18 or 19 expect to earn a bachelor's degree after high school graduation (Gray & Herr 2006). Figure 16 shows the most important reason they pursue a 4-year collage degree is that they think this way will result in a high-paying job (New America Education Policy Program 2015). Despite this goal, only 59% of students entering college will earn a bachelor's degree within 6-years (U.S. Department of Education 2017). Of those who finally complete the 4-year college degree, many will graduate with a significant amount of personal debt. According to an analysis, college students graduate with the average debt of more than $35,000 and most likely, it will increase (Kantrowitz 2014). Moreover, not only the average student debt has increased; more students are accumulating it (Figure 17). Meanwhile only 33% of jobs require a 4-year degree (Carnevale et al. 2010). Clearly, the 4-year college degree is not a suitable career path for a significant number of high school students.



Source: New America Education Policy Program, College Decisions Survey, 2015.

Figure 16: College Decisions Survey



Note: Debt includes Federal and Private Education Loans

Source: Mark Kantrowitz Analysis of National Center for Education (NCES) Statistics Data, Debt at Graduation, 2014. Retrieved from https://www.edvisors.com/media/files/student-aid-policy/20140107-debt-at-graduation.pdf*

Figure 17: Growth in Student Loan Debt at Graduation

Parents are one of the main influencers in education and career decision-making processes (Taylor 2005, Zafar 2011, Granitz et al. 2014). Many parents, teachers, and school counselors consider going to college as the only acceptable career path following high school. More interestingly among students with the least academic ability (based on standardized test scores), the growth in the percentage of parents recommending college experienced the fastest increase (Gray & Herr 2006). On the other hand, there is a perception surrounding Career and Technical Education (CTE) programs that these programs are only suitable for low-performing students and cannot prepare students for success in postsecondary education

(Brand et al. 2013). However, students who attend CTE programs have better academic grade point averages, higher rates of on-time graduation and greater success in college preparatory mathematics (Plank et al. 2008, Castellano et al. 2012, Neild et al. 2013).

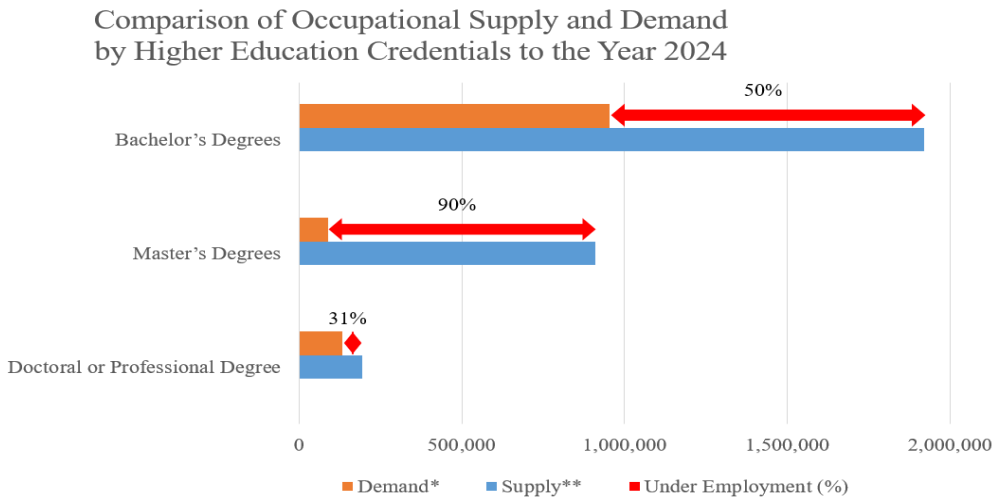
CTE programs have a positive impact on labor market transitions of young adults. CTE students reportedly are more likely to develop skills such as problem solving, math, communication, employability skills, and critical thinking during high school than their non-CTE counterparts (Lekes et al. 2007). Most human resource professionals are looking for these skills in today's workforce (Society for Human Resource Management 2014).

Part of the lack of awareness about technical occupations in society is due to not understanding the labor market as it relates to the future supply and demand for CTE occupations. The main misconceptions of the future labor market are:

- In the future, most jobs will require a 4-year degree;
- All high wage occupations will require a 4-year degree;
- The total labor force demand for college graduates will be sufficient to provide equivalent employment for all who receive a 4-year degree; and
- There will be so many individuals who have a 4-year degree that they will take all the good jobs, including those that do not require a baccalaureate degree (Gray & Herr 2006).

The reality is much different. In any given year, only 33 percent of jobs in the U.S. economy require a bachelor's degree or higher (Carnevale et al. 2010). Furthermore, the supply of 4-year degrees significantly outpaces the demand. Figure 18 provides the comparison of occupational supply and demand for bachelor's level or above in labor market. From 2015 to 2024, there are on average 955,320 jobs that will need a bachelor's degree each year; meanwhile 1,921,200 people with a bachelor's degree will be in the labor market, indicating a 50% underemployment level in labor market, which includes delayed entry

into the labor market in order to acquire the knowledge and skills an individual actually need for the jobs they attain.



Note: Demand data reflect the average of annual job openings from 2015 to 2024. Supply data reflect the average of annual degrees conferred by degree-granting postsecondary institutions from 2015 to 2024.

** Source: Projection of Education Statistics to 2024 by the National Center for Education Statistics, 2016. Retrieved from https://nces.ed.gov/pubs2016/2016013.pdf*

*** Source: Occupational Employment Projections to 2024 by the Bureau of Labor Statistics. Retrieved from https://www.bls.gov/emp/ind-occ-matrix/occupation.XLSX*

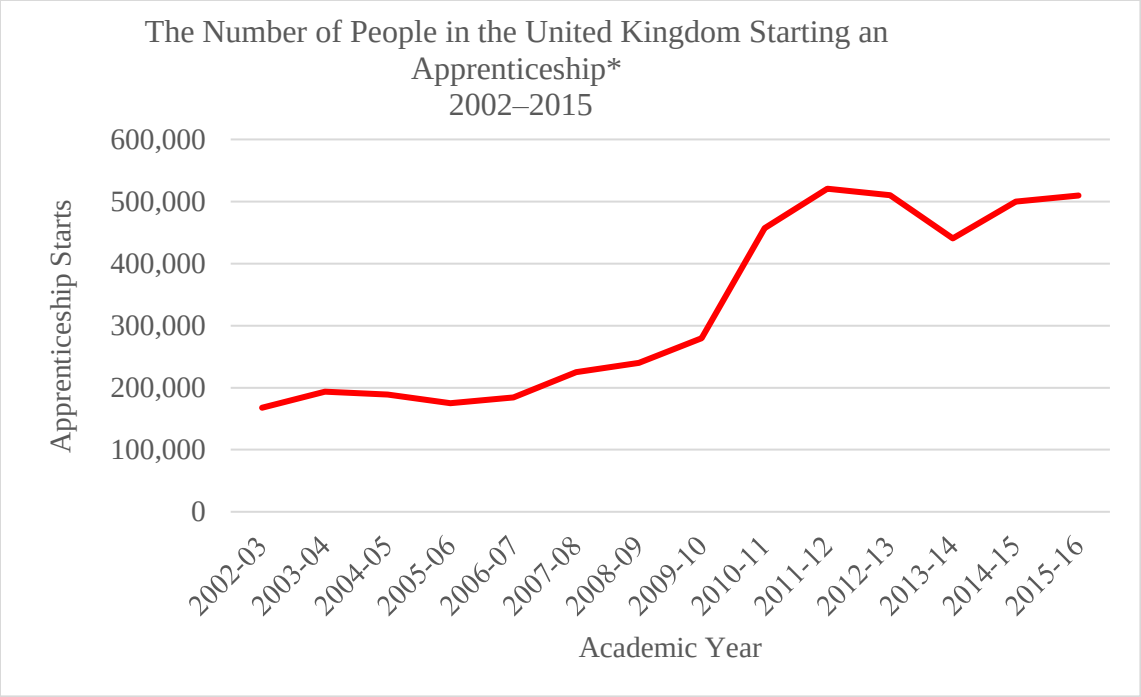
Figure 18: Comparison of Occupational Supply And Demand by Higher Education Credentials To the Year 2024

Another reason for the lack of information and awareness about career and technical occupations is that they are not as well highlighted as majors to students in secondary education compared to university degrees and do not have clear career paths for many in society. Most young people start to realize their opportunities in technical occupations after pursuing other career paths and thereby lose precious time to build their career path in other fields, like construction. As an indication, only 20% of apprentices are under the age of 25 and the average age is 30 (Lerman and Rauner 2012). In addition, the average age for apprentices in construction trades was reported 27, which is higher than that that observed in other

industrialized countries (Glover & Bilginsoy 2005). It is also significantly higher than 20 years of age, which is the average age of an undergraduate student at many U.S. universities.

Businesses can also help to improve the image of technical occupations by defining career paths within their organization and communicating these opportunities with the public. For example, some companies in the construction industry have designed internal programs that establish career pathways of promotion for their employees at the technician level to build their careers in the company leading to positions in management and supervision (McGettingan & O'Neill 2009).

Earlier discussion of the options that young people have for their career path along with future predictions of occupational supply and demand and other labor market facts can help the students and their parents make better decisions about their future. A public awareness campaign can significantly correct the misconceptions mentioned earlier. As a good example, a national marketing campaign in England has dramatically improved society's perception towards apprenticeships and trades in recent years (Olinsky & Ayres 2013). As a result, the number of people starting apprenticeship programs each year has been doubled from 2009 to 2012 in England (Figure 6).



**Source: Provided by U.K. Department for Education, "Apprenticeships geography, equality & diversity and sector subject area: starts 2002/03 to 2015/16", Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/530824/apprenticeships-starts-by-geography-learner-demographics-and-sector-subject-area.xls*

Figure 19: Growth in apprenticeship participation in UK

Who:

Department of Education, Department of Labor, and Business and Industry Leaders

What:

The message communicated to all young people in the primary and secondary education system about their future should be balanced and focused on postsecondary success instead of an emphasis on university admission. Young people and their parents need to be aware of different opportunities, the benefits, and their costs.

Several authors argued that skilled workers have become largely undervalued in the U.S. society (Schleifer 2002, Gray & Herr 2006). The research team believe that society needs to recognize and reembrace the dignity of work and stop classifying jobs as "Middle Skills" or "Blue Collar." Instead, the

construction industry uses the term “Craft Professionals”, and other industries need to follow similar suite. This policy must establish the nation’s commitment to the equality of all workers by recognizing the dignity of their contribution to society.

The communication should target federal, state and local politicians, business and industry leaders, guidance counselors, teachers, parents and young people with focus on postsecondary success instead of an emphasis on university admission.

Key areas of communication include:

- Informing young people about the options they have for navigating their chosen career pathways and the related costs;
- Clarifying labor market facts and future supply and demand of occupations in the labor market;
- Recognizing successful people who progressed through different career pathways;
- Promoting the public image of the nation’s career and technical education workforce;
- Raising awareness of all high school students in domains such as career path, credentials, apprenticeship programs, and work-based learning programs such as NCCER’s accredited craft training; and
- Introducing the ways how all students can get involved in Career and Technical Education (CTE) programs, apprenticeship, and work-based learning programs.

5.4.2 Policy 2: Revitalize the U.S. Work-Based Learning Programs

Why:

Work-based learning (WBL) refers to learning technical, academic, employability skills, discipline specific knowledge, and competencies by working in a real work environment (Alfeld et al. 2013). Work-based learning programs can be implemented in different forms. However, they generally have six characteristics in common:

- Formal arrangements are overseen by establishment of partnerships between educational institutions and external organizations,
- Some sort of contractual relationship exists between learners and organizations,
- The programs are designed based on the needs of workplace and learner utilizing structured curriculum,
- The educational level of the program is established through learners' current competencies and needs rather than their existing educational qualifications,
- An important part of learning occurs in the workplace, and
- The educational institute assesses the outcomes of the programs with respect to a framework of standards to assure the quality of learning (Boud & Solomon 2001).

Three main forms of work-based learning include apprenticeships, internship and co-operative education (Bailey et al. 2004, Alfeld et al. 2013). The emphasis in apprenticeship programs is on learning by doing. Being the most common form of work-based learning in construction, apprentices are instructed by experienced workers and supervisors at the job site and practice their skills in real work environment (Lerman et al. 2009). Internships are less well-defined and intense form of work-based learning. Usually, students spend time ranging from a few weeks to a full academic year in a position that may be paid or

unpaid (Alfeld et al. 2013). The learning connection to school curricula can vary largely (Bailey et al. 2004). Co-operative education is a form of internship but more structured. Co-operative programs are designed to place students in companies during an academic term in either a paid or an unpaid as part of a course for credit. The student's learning experience is monitored by a coordinator and/or the teacher of the course (Stern et al., 1995).

Many education reformers argue that work-based learning should be a much more significant part of the U.S. education system. However, it remains an underutilized academic strategy (Bailey et al. 2004, Alfeld et al. 2013). Although there are current on-going efforts at the time of this publication to significantly expand the use of work-based learning in the U.S. Some believe that work-based learning is limited to those who have already completed professional education and need to gain experience in their fields. From this perspective, work-based learning is a mean of transition to work and occurs after people choose their career (Bailey et al. 2004). Work-based learning can be utilized as a strategy for exploring career possibilities and gaining the knowledge and skills to prepare young people into mature and responsible members of society. Work-based learning emphasizes on education through occupations, instead of education for occupations (Hamilton 1990, Bailey et al. 2004). Furthermore, work-based learning is not only teaching new entrants into the labor market and youths a specific trade but also preparing them for adulthood (Hamilton 1990). Work-based learning should be considered a main strategy in the U.S. education system to engage new entrants into the labor market and youths earlier in career training and help develop knowledge and skills needed to prepare them for adulthood.

Per the U.S. Department of Labor (2016), approximately 500,000 apprentices were registered with the Bureau of Apprenticeship and Training in 2016. The average age of participants is 30 with most having a formal education attainment of a high school degree (Lerman & Rauner 2012). This creates a 12-year gap between post-secondary and secondary education for this population. Since most participants are well beyond high school, the registered apprentice system has not been considered as a component of secondary school education reform (Bailey et al. 2004).

Employers' participation is one of the main elements of work-based learning programs (Boud & Solomon 2001, Bailey et al. 2004). Many European countries, like Germany where work-based learning is common, have a culture of employer participation in workforce development efforts including apprenticeship. Three main reasons motivate employers to enter these programs: philanthropic motivations, individual self-interests and collective benefits (Bailey et al. 2004). Several researchers indicated that employers' commitment to their communities is at least as important as self-interest factors (Lynn & Wills 1994, Pauly et al. 1994, Bailey et al. 2004). Effectively utilizing work-based learning programs in the construction industry will lead to reduced labor costs, qualified journeymen, and ultimately long-term sustenance of the industry (Fayek et al 2003).

There are a number of issues preventing significant expansion of work-based training. These challenges include limited occupational and gender reach, poor understanding of apprenticeships among American workers and businesses, costs to businesses to involve in the programs, and lack of integration with the education system (Olinsky & Ayres 2013). The unwillingness of U.S. employers to invest in apprenticeship programs is due to several factors including the long periods of indentured service required by apprenticeships and the administrative burdens of maintaining an apprenticeship, and the reluctance of employers to train people whom may take their skills to another employer (Lewis & Stone 2011).

The administrative processes and procedures required for the U.S. registered apprenticeship programs deter the participation of companies and training programs, which results in under reporting and potentially misallocation of governmental resources. While the federal government provides significant aid for college students through subsidized and unsubsidized student loans, there is no automatic and direct assistance for businesses or workers in work-based learning programs. In contrast, the government in many other countries significantly subsidize the cost of apprenticeships. In addition, not all states have tax incentives for businesses offering apprenticeships. Other specific barriers with current apprenticeship include time requirements that are rigid, not always business-relevant, and not suitable for individuals to excel and progress. Furthermore, on-the-job training (OJT) hours are limited by available work hours on

construction jobsites, although some companies do collaborate with other companies and trade associations to overcome this challenge. Another challenge is to ensure that the OJT hours are rotated among different construction tasks and are valid in actual supervised work being performed to support the necessary learning outcome of an apprenticeship.

Adult learners need to be treated differently compared to younger learners and this has implications for work-based learning. Rogers (1996) suggests that the traditional model for teaching children is passive, while adults learn most effectively through active methods. Knowles (1984) proposes that adult learners demonstrate the following characteristics:

1. Self-directed and autonomous – need to be facilitated not taught;
2. Goal oriented – consistent with learners' goals;
3. Need for relevance and immediacy – can apply principles to practice;
4. Practical – can understand reasoning; and
5. Respected by facilitators and treated as mature adults.

One model can adapt to adult learners is competency-based learning. Competency is the capability to apply or use a set of related knowledge, skills, and abilities required to successfully perform work functions in a defined work setting (Competency Model Clearinghouse 2015). Main advantages of competency-based approach towards work-based learning include:

- Giving learners greater flexibility in balancing their studies and personal responsibilities,
- Giving learners the opportunity to study on their own pace,
- Enabling pre-assessment of competencies,

- Easier communication of the competencies needed to master to achieve career goals,
- Accelerated completion of qualification by enabling prior learning to be recognized, and
- Entering the workforce based on proven competency (Ratcliffe 2002, Yasinski 2014).

Traditional four-year apprenticeships as a main form of work-based learning may be too long to be attractive in today's labor market, and efforts need to be made to determine the shortest potential length of training necessary employing the latest techniques, without sacrificing proficiency to ensure competency of the learners (Sparks et al. 2009).

In addition, there is a difference between employers' and individuals' view on required skills. Usually employers tend to have a narrower vision of the individual's skill needs, which is more short-term in nature. Therefore, it is necessary to ensure that work-based learning programs balance this employer priority with the long-term need to equip individuals with a broader set of transferable skills. This approach ensures that individuals are equipped with a broad set of foundational skills, which will make them more resilient to potential changes in the labor market (Hamilton 2012). Industry, education and government recognized certification programs that allow workers to demonstrate proficiency against appropriate industry defined criteria is a valuable workforce development asset.

Finally, students and parents lack of knowledge about successful career opportunities afforded by WBL programs may be a significant problem for promoting these programs than other barriers (Bailey et al. 2004). The perception of parents, school administrators, counselors, and politicians towards work-based learning should be changed. Work-based learning should not be considered a lessor alternative compared to traditional academic learning or failure. Rather, it is an equivalent occupational pathway.

Who:

Federal and State governments, Department of Education, Department of Labor, State Departments of Economic Opportunity, and State Department of Commerce, Business and Industry Leaders

What:

To significantly improve work-based learning programs, these initiatives need to occur:

- Streamline the bureaucratic requirements and administrative processes for both employers and training providers in order to encourage them to participate in registered apprenticeship programs by
    - Reducing time to approval; and
    - Providing consistent guidelines for applications and reporting guidelines across all states
- Recognizing work-based learning models such as the ones provided by the National Center for Construction Education and Research (NCCER) and North America Building Trades Apprenticeship Programs;
- Providing Federal and State tax incentives for employers who invest in developing their workers;
- Creating more flexible training schedule options according to companies' constraints and available positions by encouraging the development of competency-based and accelerated training; and

- Allocating Federal and State funding and providing tax incentives to registered apprenticeships and work-based learning programs based on both program enrollments and their performance.

5.4.3 Policy 3: Measure Performance and Involvement in Workforce Development When Awarding Construction Contracts

Why:

A skilled workforce is essential to safety, productivity and sustainability of construction and maintenance activities. Studies show that projects with skilled workforce shortage experience cost and schedule overruns and increased safety incidents (Karimi et al. 2016, 2017).

As owners recognized the importance of safety, they held their contractors to high standards of safety performance. Owner initiatives in this regard, such as improvement in construction safety and industry adoption of advanced technologies, have resulted in significant industry-wide changes in safety performance.

Similarly, owners have noticed that a qualified workforce is critically important to safety, productivity, on-time, and on-budget completion of construction projects. They also understand that the competence and quality of a contractor's workforce is the direct result of the contractor's commitment to workforce development.

A previous CII research (CII RT-252) examined the use of the Construction Workforce Development Assessment (CWDA), which was developed by NCCER and Construction Users Roundtable (CURT) in collaboration with ABC, and AGC (Associated General Contractors of America). The CWDA provides a 0 to 100 rating of a contractor's commitment to workforce development across a range of elements. The intention of the CWDA is to allow workforce development to become a key criterion in both the prequalification and the final selection of contractors, just as contractor safety, quality, and schedule are key selection criteria.

CII RT-252 found that construction firms that score higher on the CWDA also reported lower recordable incident rates, which is an indication of overall improved construction performance. The study also revealed that the most important workforce development element is the firm's formal policy for or commitment to providing a formal craft skills training program. Interestingly, the contractors, owners, and other training professionals that participated in the study had the same perception towards the relative importance of workforce development elements.

Owners must require contractors to invest in training and improve the skill sets of their workforce. Moreover, contractors must recognize the necessity and benefits of investing in their employees.

Who:

Municipal and private purchasers of the construction industry services

What:

The nation's government and businesses must become more engaged in workforce development as part of ensuring the future availability of skilled labor. Governmental agencies and businesses who issue construction contracts need to include construction firms' dedication and commitment to workforce development in much the same way as safety, quality, schedule and cost is considered today. Perhaps by offering high tax incentives to employers whose workforce development programs have been evaluated and rated by a third party, the Federal and State government can encourage construction firms to provide more rigorous workforce development programs. Metrics such as CWDA which allow to effectively evaluate a contractor's workforce development commitment and program quality can be used by third parties to audit construction firms.

5.4.4 Policy 4: Redefine How We Measure the Quality of the U.S. Secondary Education System by Career and College Readiness

Why:

In terms of preparing graduates of the U.S. secondary education system, "career readiness" and "college readiness" are currently used interchangeably. Although academic proficiency is essential for any post-high school achievement, career readiness is a broader concept than just preparing individuals for university studies. The goal of career readiness is to prepare every student for a successful transition into the workplace as a productive member of society.

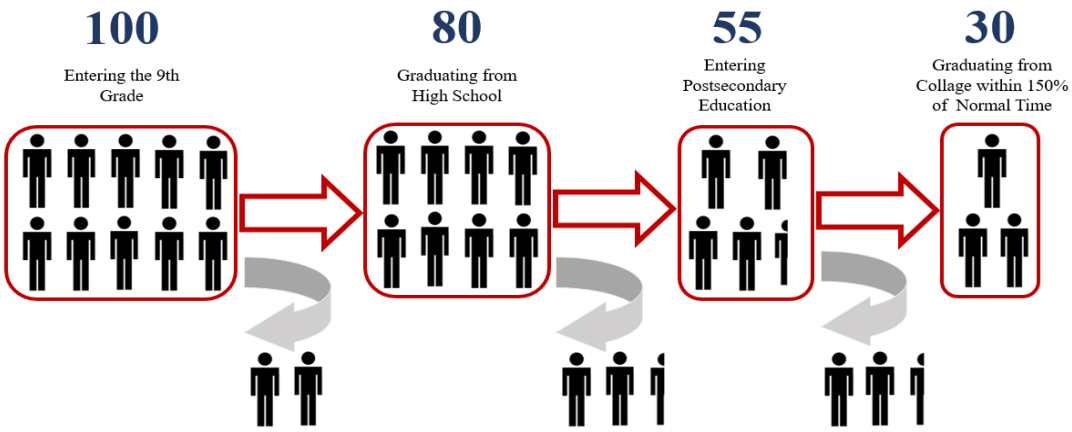
From a macro perspective, the interconnectedness of the secondary education system with the economy makes career readiness important. Society can be considered as a system of interconnected parts or subsystems (e.g. industry, education, government, community, etc.). In long run, each part influences and is influenced by other parts to maintain a state of balance for the whole (Parsons 1971). The secondary education system is a subsystem and in a dynamic relationship with its social context (Hodge 2007). From this perspective, the interconnectedness of the secondary education system with the economy makes career readiness important.

However, several indicators show that there is misfit between the education system and the U.S. economy. Studies indicate there is a skills gap in the labor market (Symonds et al. 2011, Albattah et al. 2015). A recent survey conducted by Manpower Group (2016) found that construction craft workers, technicians, sales representatives and machine operators are the top jobs that employers have the greatest trouble finding qualified applicants. These are the type of jobs that CTE training programs are meant to address by providing a qualified workforce. Specifically, about 26,000 construction firms participated in the Associated General Contractors of America's (AGC) survey in 2017 and reported that growing workforce shortages have made it difficult to find qualified workers and will continue to be a challenge in the foreseeable future. The U.S. labor market faces a situation in which many young adults lack the skills required for many job needed by the economy (Symonds et al. 2011).

In today's society, there is an implicit assumption that just entering the college can guarantee young adult's success in the labor market and this is the only way to succeed (Gray & Herr 2006). However, data suggests a different story. Figure 20 indicates that for every 100 students entering the 9th grade, only 80 will graduate from high school on time; only 55 will enter postsecondary education and training; and only 30 will graduate from college with a bachelor's degree within 6 years or an associate in three years. Despite this enthusiasm for earning a four-year college degree, not all young adults can successfully finish college. In fact, the college dropout rate in the U.S. is the highest rate among the industrialized countries (Symonds et al. 2011). According to U.S. Department of Education, only 59 percent of those enrolling in a four-year college attain a bachelor's degree after six years (U.S. Department of Education 2017). Only about 40 percent of young people attained either an associate's or bachelor's degree by their mid-twenties. This number is even lower for young people of color: 30 percent for African-Americans and 20 percent for Latinos (Symonds et al. 2011). These numbers remind us that while attaining a four-year college degree is a viable option for some, it cannot be the only path for success.

One of the main goals of the education system is to train accountable professionals. Accountability refers to the expectation that professionals should have enough knowledge in their fields and ability to employ that knowledge in practice (Norton et al. 1978). Nevertheless, the education system does not have any specific plan for young people who neither intend to go to college nor finish it successfully. Some authors referred to this group as the "forgotten half". They argue that the education system prevents them from pursuing an opportunity of meaningful participation in society, because they are not well equipped with required skills and knowledge (Gray & Herr 2006, Symonds et al. 2011).

Educational Pipeline*



**Source:*

U.S. Department of Education, National Center for Education Statistics. (2017). The Condition of Education 2017 (NCES 2017-144), Public High School Graduation Rates, Retrieved from https://nces.ed.gov/programs/coe/indicator_coi.asp

U.S. Department of Education, National Center for Education Statistics. (2017). The Condition of Education 2017 (2017-144), Immediate College Enrollment Rate, Retrieved from https://nces.ed.gov/programs/coe/indicator_cpa.asp

U.S. Department of Education, National Center for Education Statistics. (2017). The Condition of Education 2017 (NCES 2017-144), Undergraduate Retention and Graduation Rates, Retrieved from https://nces.ed.gov/programs/coe/indicator_ctr.asp

Figure 20: Educational Pipeline

However, the U.S. education system places significant emphasis on college readiness (Symonds et al. 2011). High schools exert significant implicit and explicit pressure on students to choose to go college. Some of these pressures are institutionalized in form of: college fairs, campus visitations, financial aids, college-choice workshops for parents, announcing list of graduates, the colleges they are planning to attend, and scholarships they have been awarded, and giving extra value to grades earned in special college prep courses (Gray & Herr 2006). In addition, some argued that the state and federal programs such as No Child Left Behind renewed the push for high scores on standardized tests (Clark 1997).

It is noteworthy to mention indicators measured by non-governmental entities such as U.S. News' and Newsweek's high school rankings also do not consider career readiness (Newsweek 2014, U.S. News

2017). Rather, most high school rating indexes place significant weight on college readiness, which does not meet the need of many high school graduates whose interest are in occupations are outside the scope of university studies. Instead, the goal of CTE is to provide people with the academic, technical, and employability skills and knowledge to pursue postsecondary training or higher education and enter a career path (Association for Career and Technical Education 2007). These programs are designed to help individuals to attain the competencies such as critical thinking, collaboration, problem solving, teamwork, and communication by work and workplace exposure (Brand et al. 2013).

In definition of career readiness, some focus on specific education programs rather than on a progression into employment (Bragg et al. 2007). On the other hand, other definitions consider career readiness in a broader scope by defining it as an individual's occupational preparation and longer-term solution to employment and skills shortages (Baran et al. 2011).

According to the Association for Career and Technical Education (ACTE 2007), career readiness is defined as:

- Core academic skills and the ability to apply those skills to concrete situations in order to function in the workplace and in routine daily activities;
- Employability skills (such as critical thinking and responsibility) that are essential in any career area; and
- Technical, job-specific skills related to a specific career pathway.

Several studies document the positive effects of CTE on students' test scores, academic grade point averages, and graduation rates (Kulik 1994, Plank et al. 2008, Castellano et al. 2012). U.S. Department of Education data (2014) also indicate average high school graduation rate for students concentrating in CTE is 93% compared to the 80% national average. One possible explanation for these positive impacts is that students who are participating in these programs can see the clear connection between learning materials and tangible opportunities in the labor market (Symonds et al. 2011). Other research found that the work-

based learning environment provided by CTE training programs helps students apply their learning in real settings, increase academic motivation, navigate their career path and develop critical understanding of the work requirements (Alfeld et al. 2007). Although these positive effects are not limitless and there is a threshold for it (Plank et al. 2008).

Since the education system is a key driver of U.S. economic system, one of its main goals is to provide the economy with the inflow of required talents. The over-focus of U.S. society on 4-year college degrees over the past several decades, through a noble a well-intended goal, has thrown the interconnected systems of society out of balance and is detrimental to both society and the individual. By measuring the performance of the secondary education system based on both students' career readiness and college readiness, we can ensure that the needs of all of our nations' high school students are met as well as the needs of the U.S. economy.

Who:

Federal and State government, Department of Education, Department of Labor, and Business and Industry Leaders, Community Colleges and Universities

What:

This policy recommends that the U.S. education system adopt a standard to measure individual's career readiness in order to evaluate the performance of the nation's secondary education system and to provide greater incentive to ensure the career readiness of all high school graduates. At a minimum, all high school graduates should be career ready. In addition, all high school graduates be prepared to pursue a variety of post-secondary opportunities including career and technical education, work-based learning, and colleges and universities and primary and secondary school systems should be evaluated on their effectiveness in preparing students for post-secondary opportunities with equal weighting to all post-secondary options.

The message communicated to all young people in the primary and secondary education system about their future should be balanced and focused on postsecondary success instead of an emphasis on a single post-secondary opportunity (e.g. university admission). Young people and their parents should be aware of different opportunities and their costs.

5.4.5 Policy 5: Increase the Participation of Underrepresented Groups in CTE

Why:

The groups that represent the greatest opportunity for new workers in the construction industry include women, minorities, and veterans. To increase the numbers of these groups within the construction industry we must increase their presence within secondary and post-secondary CTE programs. This policy helps in recruiting these individuals into construction, but the industry must do a better job of retaining these future professionals with improved worksite conditions and other incentives.

Regarding participation of women craft workers, a study conducted by National Women's Law Center indicated, the percentage of women in construction trades has remained almost the same from 1983 to 2010 (National Women's Law Center 2012). This creates a major contrast between jobs in the construction industry and other industries regarding gender diversification. In fact, the percentage of women in many occupations that used to be more male-dominated have increased during the same time (i.e., 1983 to 2010). Increasing female participation in construction craft occupations is one of the quickest solutions available to the industry to reduce its skilled workforce shortage (Schleifer 2002).

Immigrants have always played a significant role in the U.S. labor force (The Center for Construction Research and Training 2010). The construction industry has experienced a dramatic growth in the number of immigrant workers during last decades, vast majority of them coming from Latin American countries (Burnette 2006). It is estimated that immigrants now account for about 23 percent of the construction workforce while 84 percent of them come from Mexico and other Latin American countries (Siniavskaia 2015). Nevertheless, most immigrant workers are concentrated in occupations with relatively

low wages which do not require high skills and a formal education (Goodrum 2004, Siniavskaia 2015). Immigrant workers have also higher percentage of job-related incidents and fatalities (Dong & Platner 2004, Goodrum & Dai 2005, Hurley & Lebbon 2012). These findings suggest greater demand for investing in immigrant workers in areas such as hiring, education and training, communicating and building trust, improving working conditions and overcoming language and cultural barriers (Goodrum & Dai 2005, Dai & Goodrum 2011, Hurley & Lebbon 2012).

There are programs to assist veterans in transitioning into the civilian workforce, such as Helmets to Hard Hats and Hard Hat Heroes. However, the communication and utilization of these programs must be improved.

Additionally, ex-offenders represent a huge labor pool but they are not always welcomed into the construction industry (Schleifer 2002). Ex-offenders can also be another source of skilled workers. In spite of having received certification through National Center for Construction Education (NCCER), American Welding Society (AWS), Automotive Service Excellence (ASE), and other entities, many ex-offenders are either unemployed or underemployed (Louisiana Workforce Commission 2013). The construction industry can help and motivate ex-offenders to be employed in the industry and provide better long-term outcomes for these individuals by offering initiatives suggested under this policy.

There are a number of obstacles to reaching these specific labor populations:

- The lack of CTE programs available to these individual in either their secondary, post-secondary, or communities;
- Currently, many lack the educational background, fundamental-intermediate technical skills, and industry experience for entry level employment, and the skill sets required for success;

- Many individuals from underrepresented groups do not understand or are not aware of the industry career opportunities;
- Many lack knowledge on how to tap into the industry for job opportunities; and
- Many lack financial resources to attend technical training and may have cultural and language barriers that hinder their ability to learn and grow.

Who:

Federal and State government, Department of Education, Department of Labor, Department of Defense, Department of Corrections, Community Based Organizations, and Business

What:

We increase the recruitment of underrepresented groups in CTE through these initiatives:

- Without a more inclusive and accommodating workplace environment, increased participation within CTE programs from these groups will not be successful. The construction industry must improve job site conditions and company policies to attract and retain under-represented groups into construction.

- Initiate mentoring programs specifically designed for women within CTE programs;

- Utilize Community/Faith Based Organizations that are familiar with the immigrant population for outreach, recruitment and coordination of vocational-English-as-a Second Language (VESL), training activities, job readiness, job requirements and expectations;

- To assist and raise the awareness of veteran focused CTE training programs, strengthen and support hiring opportunities for veterans;

- Develop and implement marketing and outreach strategy that specifically targets the underserved areas/populations;

- Establish a pool of resources such as retiring industry personnel to teach, mentor, and tutor CTE program participants; and

- To better support CTE programs within correctional facilities, encourage project owners with low security level clearance requirements on their projects to utilize ex-offenders to fill staffing needs.

5.4.6 Policy 6: Establish and Expand Collaboration between Industry, Education, and Government

Why:

At a minimum, all secondary and post-secondary graduates must be career ready and better collaboration between industry, education, and government will ensure this standard is satisfied. Industry and business leaders directly feel the challenge of recruiting people in non-managerial role with required skills, training, and education (Bridgeland et al. 2011). To promote CTE in both secondary and post-secondary education levels, the industry must take an active role and educational institutions must value industry feedback. Since CTE courses often combine classroom-based instruction with work-based learning, internships, or apprenticeships, students will be provided with the opportunity to work with local employers (Brand et al. 2013). On the other hand, industry can carry out several important roles to reinforce CTE. Businesses and firms can serve as advisors to CTE programs to ensure that curriculum and instruction are relevant, up to date, and reflect changing technologies and knowledge. They can provide information about careers and the skill sets needed to hold certain jobs, mentor students about career opportunities and pathways, donate equipment, provide industry experts as adjunct faculty or volunteer teachers, and offer teachers externships during the summer so that they can learn about new careers, processes, and technologies (Hamilton 2012, Brand et al. 2013).

However, there are obstacles facing government, businesses and educators to cooperate in promoting CTE. Finding community colleges and/or employers that are willing to develop partnerships or offer work-based placements can be challenging (Brand et al. 2013). Some employers, particularly in small and medium sized firms where the majority of new jobs are being created, neglect to engage in workforce development initiatives (Hamilton 2012).

On the other hand, employers are often frustrated with the speed of government agencies and educational institutions to respond to their immediate needs. To respond to this challenge, states have established regional groups of employers within an industry, who advise workforce and education agencies. Such examples exist in both Alabama and California, which have developed regional workforce development boards to provide an interface between industry and regional school districts and community colleges (Hamilton 2012 and Made in Alabama 2018). Such industry and governmental collaborations, include European Chambers of Commerce organization in Austria, Germany, and Switzerland, play a significant role in fostering CTE programs in these respected countries and help industry develop work-based training programs. A similar collaboration on a national scale in the U.S. is the National Fund for Workforce Solutions, although it does not have that level of governmental involvement due to it private source of funding.

Another successful example of such collaboration in the U.S. is Louisiana's Jump Start program. The program provides high school students with the opportunities to attain industry-valued credentials in their career paths that lead them to high demanding jobs. At the same time, they are prepared to continue their post-secondary education. This collaboration between school districts, colleges, businesses and workforce development experts help K-12 CTE strategy to be aligned with the state's economic development strategies (Louisiana Department of Education 2015).

Most successful and sustainable CTE programs have succeeded in establishing partnerships among business, industry, the state, and educators. Therefore, this policy helps to improve the collaborative relationships between government, education system, construction training providers, and industry.

Who:

Federal and State government, Department of Education, and Business and Industry

What:

The goals of expanding business and industry collaboration with governmental and education are to:

- Within any system, metrics will drive system behavior. The primary goal of educational systems should be to produce productive citizens. Educational systems should be required to collaborate with industry, education, and government in performance metrics.

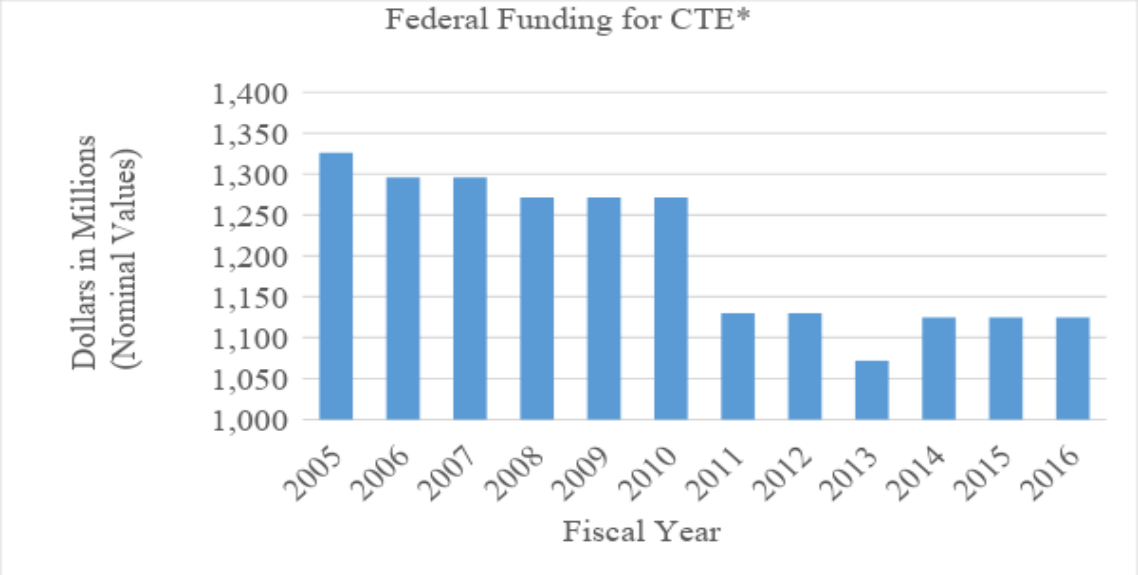
- Identify competencies needed by the industry for the jobs and careers they provide;

- Help to evaluate and identify Career and Technical Education (CTE) curricula and training materials according to industry needs;
- Support and encourage industry workforce development by collaborating with mentors, instructors, and other stakeholders in the education system at all levels;
- Promote industry involvement and investment into the U.S. secondary and post-secondary Career and Technical Education (CTE) programs; and
- Assist industry and educational institutions in navigating governmental regulations as it relates to CTE and work-based training programs.

5.4.7 Policy 7: Develop More Balanced Funding Among Post-Secondary Career and Technical Education versus University Systems

Why:

Several data sources show that the overall money received by Career and Technical Education programs across the U.S. has declined over the last decade. In fiscal year 2016, Department of Education assigned $1.13 billion or just 1.7 percent of the total $68 billion budget to Career and Technical Education (U.S. Department of Education 2016). It is estimated that Federal contribution to CTE is at five percent with state and local dollars supporting teachers' salaries and much of the CTE infrastructure (Dortch 2012). Figure 21 illustrates the nominal Federal budget for Career and Technical Education has declined by 18 percent since 2005, although the overall education budget has increased during this period. Considering the decrease in value of the U.S. dollar between 2005 and 2016, the actual CTE budget has experienced even greater declines.



** Source: Numbers adopted from the U.S. Department of Education annual budget summary from 2005 to 2016 available at https://www.ed.gov/*

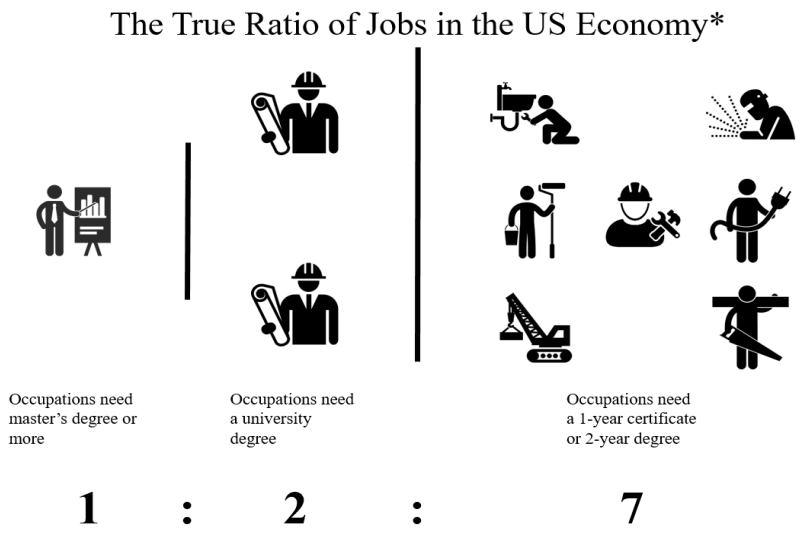
Figure 21: Federal Funding For All Career and Technical Education (CTE)

According to the Association for Career and Technical Education, approximately 96% of CTE educators reported that their program budgets have declined or have been stagnant (Association for Career

and Technical Education 2016). Another survey conducted by National Association of State Directors of Career Technical Education Consortium indicated that most secondary and post-secondary CTE programs experienced a decline in both Federal and State funding while interest in CTE has increased at the same time (National Association of State Directors of Career Technical Education Consortium 2013).

The U.S. must invest more in CTE. CTE programs offer various benefits to students by improving educational attainment and engagement and providing a clear and meaningful connection between education and career paths (Kulik 1994, Plank et al. 2008, Symonds et al. 2011, Castellano et al. 2012). From a macro perspective, skilled workforce shortages have become critical in several industries such as construction and manufacturing (Symonds et al. 2011, Albattah et al. 2015). It is vital for the government to understand the value of CTE in providing industries with a greater skilled workforce. As discussed earlier and depicted in Figure 22, the U.S. industry typically requires 30% of the workforce with a university degree (including a bachelor or graduate degree) and the remaining 70% possess some form of CTE certification (Gray & Herr 2006). As a result, industry need supports the increased funding in CTE education.

CTE is expensive to implement due to costs associated with lab set-up, equipment and materials purchase. Funding issues also influence recruitment of appropriate instructors. Because they can earn so much more money performing the work, it is always difficult to find knowledgeable and industry-certified instructors for CTE programs at the high school and Tech College/Community College level.



Note: Based on the U.S. labor market data, for every occupation that needs a master's degree or more, two professional jobs require a university degree, and there are seven jobs requiring a 1-year certificate or 2-year degree. This ratio is a fundamental to all industries

Source: Gray, K. C., & Herr, E. L. (2006). Other ways to win: Creating alternatives for high school graduates. Corwin Press*

Figure 22: True Ratios of Jobs in the US Economy

Improved balanced funding will promote more Career and Technical Education and internship programs and encourage greater industry engagement among post-secondary education institutions. Existing public funding sources are often misaligned with business and industry needs and are not well coordinated from program to program and agency to agency. In addition, the industry is often unaware of the types of funding available to support needed workforce development programs or the mechanism to influence the type and direction of program funding.

Who:

Federal and State government, Department of Education

What:

A sizable portion of public education and workforce funding is not effectively allocated to meet the needs of the national economy. To address this issue, the goal of this policy is to increase funding

available to CTE programs most needed by industry. To achieve this goal these initiatives are recommended:

- Incorporate work-based training requirements into federal funding of education programs.

- Re-evaluate how existing funding can be used to support technical training; expand the allowance for Title IV funding (e.g. Pell grants and Perkins Bill funding) to apply to appropriate, industry recognized, accredited technical schools and programs.

- Streamline governmental funding for workforce development by consolidating both federal programs and emphasize the use of industry match to better align the available resources with industry need. Examples include:

    - Canada-Alberta Job Grant Program;

    - Workforce Innovation and Opportunity Act (WIOA) solutions; and

    - State-supported tuition programs for Career and Technical Education (CTE) such as Tennessee College of Applied Technology -TCAT.

- Increase industry/company funding/investment in Career and Technical Education (CTE) programs through appropriate governmental tax incentives, internships, and scholarships;

- Establish competitive grants for states seeking to expand their work-based training and apprenticeship programs;

- Ensure incentives exist for individuals to enter into and complete the program (qualifications and employment); and

- Raise awareness among both public and private funding organizations of the imminent need to focus their attention on high growth industries, such as construction.

5.4.8 Policy 8: Create a National System that Tracks Participation and Completion of Formal Craft Training, Registered Apprenticeship, and Non-Registered Apprenticeship Programs

Why:

There is no a nationwide tracking system to identify individuals that have participated or completed formal craft training, registered apprenticeship, and non-registered apprenticeship programs. While based on industry survey data, company case studies, and governmental data sources, Wang et al. (2008) found that the majority of construction craft training is informal. There is also evidence that the Department of Labor's Registered Apprenticeship Program underreports the actual number of apprentices in the United States (Lerman 2012). In comparison, most other countries produce more accurate estimates on the number of registered pets (Bradley & King 2012) than the U.S. has access on the number of certified and qualified construction craft professionals.

Not all businesses in the U.S. are fully aware of benefits of participating and investing in formal craft training, registered apprenticeship, and non-registered apprenticeship programs. Research in this area using hard data can help establish the credibility and promote all forms of work-based training in the U.S (Olinsky & Ayres 2013). As an example, one research illustrated that Canadian businesses received benefits, on average, of $1.47 for every $1 spent on apprenticeship training (Canadian Apprenticeship Forum 2009). Using the trade-specific data, the study could demonstrate the industry detailed breakdown of the costs and benefits of apprenticeship training as well as the average benefit for each trade.

Our nation's construction craft workforce is a national asset that deserves more careful and accurate monitoring. Lack of accurate and coherent data makes it difficult to measure the performance of the U.S. workforce development system and compare it with the performance of other countries. A better data

collection system in the U.S. would help improve the design of work-based training programs and persuade businesses to engage more in this area.

Who:

Federal and State government, Business and Industry

What:

A nationwide tracking system enables the government to track the number of people participating in formal craft training, registered apprenticeship, and non-registered apprenticeship programs. The information obtained from this system can be used in performance evaluation, planning, and research.

Also, it is recommended that Department of Labor involve more detailed job classification in Bureau of Labor Statistics (BLS) database and include questions on job certification/journeyman status in Current Population Survey.

5.5 APPLYING THE AHP MODEL

For the pairwise comparisons, the experts were asked to subjectively evaluate the relative importance of items using the scale from one to nine (where nine is extremely important and one is equally important). As an example, if someone thinks the effectiveness is extremely more important than the sustainability, it means he or she thinks that effectiveness is 9 times more important than sustainability. These pairwise comparisons should be done for both criteria and alternatives.

Table 18 shows the priority weights of each criterion. To do benefit/cost analysis, I assumed that they have the same priority. Under benefits and costs clusters, weights of sub-criteria are computed by using pairwise comparison between each criterion through questionnaire distributed among the experts in our research team.

Table 18: Priorities of Criteria and Sub-Criteria

		Weights		Weights
Criteria	Benefits	0.50	Costs/Risks	0.50
Sub-criteria	Effectiveness	0.48	Cost of Implementation	0.33
	Sustainability	0.21	Political feasibility	0.23
	Flexibility	0.31	Social acceptability	0.30
			Administrative feasibility	0.14

According to Saaty (1980), priorities make sense only if derived from consistent or near consistent matrices. It is necessary to check the consistency of comparisons done by each team member and the research team as a whole. In simple language, consistency means that if alternative A is preferred over B and B is preferred over C, then clearly A must be preferred over C. Now if in a pairwise comparison between options C and A, option C is preferred over A, there is an inconsistency in evaluation.

To quantify consistency, Saaty (1980) proposed a consistency index (CI), which is related to the eigenvalue method:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

where n is the dimension of the matrix; λ_{max} is maximal eigenvalue.

The consistency ratio, the ratio of CI and RI, is given by:

$$CR = \frac{CI}{RI}$$

where RI is the random index (the average CI of 500 randomly filled matrices). If CR is less than 10%, then the matrix can be considered as having an acceptable consistency.

After each individual answered the questionnaire, I calculated the CI for each cluster. In case, there was an inconsistency in answers, the individual was invited to re-evaluate his/her answers. After two rounds, all participants met the less than 10% consistency ratio criterion. The team as a whole has the

consistency ratio of 0.4% for benefits cluster and 1.9% for costs/risks cluster. It is noteworthy to mention that to aggregate the results the geometric mean of individual evaluations are used as elements in the pair-wise matrices and then priorities are computed (Aczél & Saaty, 1983).

One challenge for doing pairwise comparisons in AHP is that the number of required comparisons can be very high: $(n^2-n)/2$ for n alternatives/criteria (Ishizaka & Labib 2011). In this model to compare all policies with respect to criteria, respondents should answer 196 questions. This can make the process exhausting for the respondents and force them to answer questions with a small reflection time and less accuracy (Ishizaka & Labib 2011). Therefore, the incomplete pairwise comparison approach adopted for comparing policies. In this approach, the number of questions should be answered dropped significantly.

To implement incomplete pairwise comparison, respondents should answer seven compulsory questions for each criterion. These questions were related to upper diagonal of the comparison matrix (Ishizaka & Lusti 2006). This means respondents should compare policy one with policy two, policy two with policy three, until policy seven with policy eight. After answering these seven compulsory questions, they started to continue the comparisons until the percentage of change in absolute weights of policies from one question to another dropped below a certain threshold (Harker 1987). With this method, respondents are not required to do all the comparisons.

To calculate the weights with incomplete pairwise comparison, the method suggested by Harker (1987) was used. According to Haker (1987), if I consider the matrix A with missing comparisons, the method to calculate the priorities has two steps:

(i) A new matrix B is created from the incomplete matrix A:

– $b_{ij} = a_{ij}$ if a_{ij} is a real number > 0

– b_{ij} = 0 otherwise

– b_{ii} = the number of unanswered questions in the row i.

(ii) The eigenvalue method is applied on the matrix B = A + I, where I is the identity matrix.

To implement this approach in practice, the research team developed a decision support system using Microsoft Excel and Visual Basic. The system automatically updated the weights of policies after answering each question, informed the respondent to stop answering after reaching the threshold and calculated the consistency ratio and suggested the options to improve the inconsistency ratio.

This system provides three main advantages for the decision maker:

1. It is simple and easy to use. The questionnaire is provided in Excel and respondents can answer the questions just by clicking on the buttons.

2. Instead of answering 196 questions, it helps you to answer much fewer questions. Depending on the way respondent answers, it can reduce the number of questions you need to answer by 50%.

3. It helps the respondents to keep their consistency by providing feedback. Since the respondents need to answer several questions, it might be hard to keep their consistency. The software gives them feedback on the consistency of their answers and provides recommendations to improve it.

Figure 23 illustrated snapshot of the Decision Support System developed for this research.

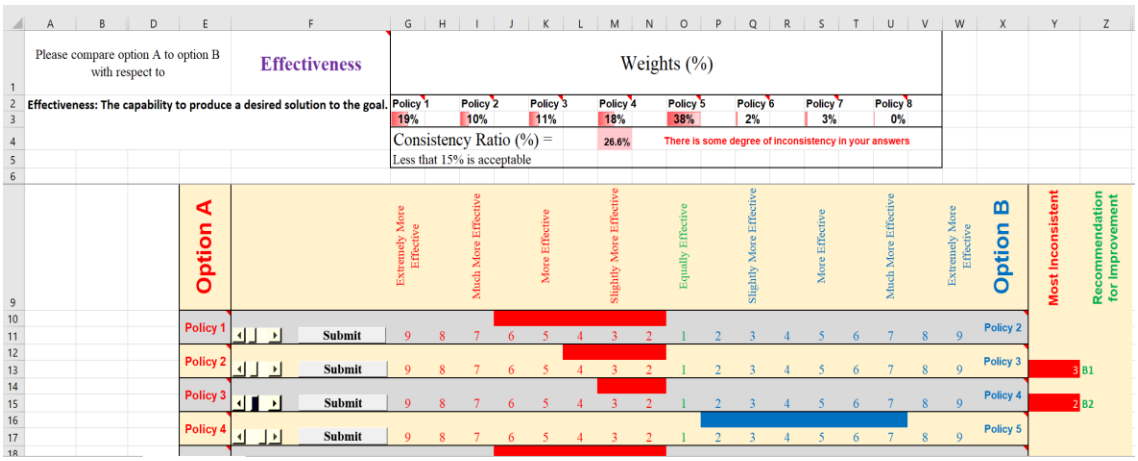


Figure 23: Snapshot of Decision Support System Developed For AHP Model

The final weights for AHP model, which represent the preferences of all experts in the group, were calculated using mathematical aggregation. Again, the geometric mean of individual evaluations are used to aggregate the results of the team (Saaty & Vargas 2005). Again, the consistency index for each individual was checked to achieve the less than 10% consistency ratio criterion.

I used a short title for each policy to easily communicate the results (Table 19). Tables 20 and 21 shows the relative weights of each policy under benefits cluster, costs/risks cluster, and their sub-criteria.

Table 19: Short Title of Policies

Policy	Short Title
Establish and Strengthen the Awareness of Career Opportunities in The U.S.	Strengthen the Awareness of CTE
Revitalize the U.S. Work-Based Learning Programs	Revitalize Work-Based Learning
Measure Performance and Involvement in Workforce Development When Awarding Construction Contracts	Consider Workforce Initiatives When Awarding Contracts
Redefine How We Measure The Quality of The U.S. Secondary Education System by Career and College Readiness	Emphasis on both Career and College readiness
Increase the Participation of Underrepresented Groups in CTE	Increase the Participation of Underrepresented Groups
Establish and Expand Collaboration between Industry, Education, and Government	Increase Collaboration
Develop more balanced funding among post-secondary Career and Technical Education versus University Systems	Balanced Funding
Create a National System that Tracks Participation and Completion of Formal Craft Training, Registered Apprenticeship, and Non-Registered Apprenticeship Programs	National Tracking System

Table 20: Weights of Policies Based On Their Benefits

Policies	Benefits	Effectiveness	Sustainability	Flexibility
Strengthen the Awareness of CTE	0.140	0.118	0.168	0.155
Revitalize Work-Based Learning	0.145	0.167	0.117	0.132
Consider Workforce Initiatives When Awarding Contracts	0.177	0.192	0.173	0.155
Emphasis on both Career and College Readiness	0.132	0.128	0.138	0.133
Increase the Participation of Underrepresented Groups	0.095	0.075	0.115	0.112
Increase Collaboration	0.121	0.116	0.123	0.127
Balanced Funding	0.137	0.157	0.102	0.129
National Tracking System	0.053	0.046	0.064	0.058

Table 21: Weights of Policies Based On Their Costs/Risks

Policies	Costs/Risks	Cost	Political Feasibility	Social Acceptability	Administrative Feasibility
Strengthen the Awareness of CTE	0.170	0.145	0.180	0.172	0.211
Revitalize Work-Based Learning	0.121	0.115	0.105	0.145	0.108
Consider Workforce Initiatives When Awarding Contracts	0.160	0.203	0.178	0.123	0.108
Emphasis on both Career and College Readiness	0.107	0.129	0.081	0.093	0.130
Increase the Participation of Underrepresented Groups	0.157	0.130	0.195	0.177	0.115
Increase Collaboration	0.117	0.116	0.114	0.115	0.129
Balanced Funding	0.106	0.112	0.068	0.118	0.130
National Tracking System	0.061	0.049	0.079	0.058	0.069

The results of group AHP are categorized based on the relative benefits and costs of each policy. By using the median score for both benefits and costs/risks, a graphical plot was developed to divide it into four quadrants (Figure 24).

I have organized the policies in three groups. The policies in the first group have relative high benefits and low costs/risks. The policies in this group include strengthen the awareness of CTE, consider workforce initiatives when awarding contracts, and revitalize work-based learning programs. The research team believe that the policies in this group have the potential to implement in the short-term. The policies in the second group have either relative high benefits and high costs/risks or relative low benefits and low costs/risks. Increase the participation of underrepresented groups, increase collaboration, emphasis on both career and college, and balanced funding are policies that fall under the second group. The research team

believe that these policies will require a longer term effort to implement. One policy, which is to create a national tracking system, is ranked with relative low benefits and high costs/risks. The team members reached a consensus that it is better to remove this one from policy recommendations.

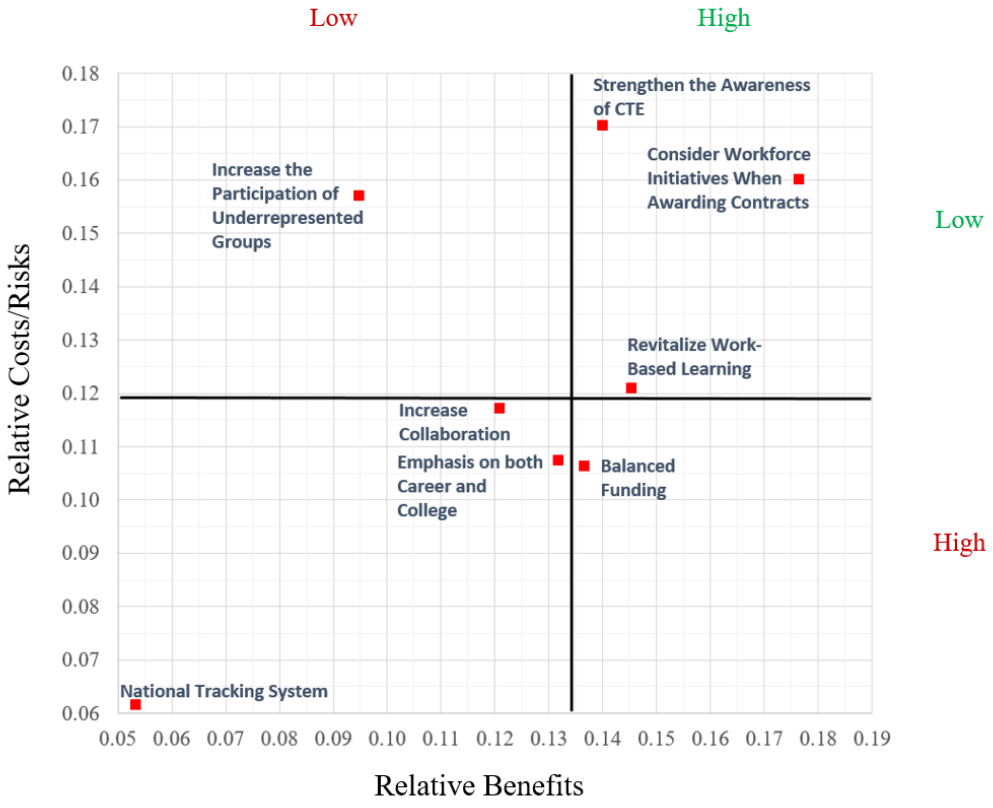


Figure 24: Benefit-Cost Analysis of Policy Recommendations

5.6 CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

The United States' workforce development system is in need of expansion and renewal. Over the past three decades, I have seen a construction workforce shortage emerge. The shortage has worsened to the point that it is not only hard to find quality craft workers, but the shortage is affecting projects' schedule, cost, and safety. If no action is taken, the shortage of craft professionals will get worse and likely accelerate in the next decade due to an aging construction workforce.

The main goal of this research is to recommend policies that help renew the U.S. workforce development system and overcome the challenges. To define this path forward, a series of policies have been developed that impact industry stakeholders and governmental agencies. Considering the relative benefits and costs with each policy, there are policies I can be implementing today, in the short term, and there are policies that will require long-term sustained efforts.

The short-term policies include:

Establish and strengthen the awareness of career opportunities in our nation: Most graduating high schools expect to earn a bacheolor's degree for employment opportunities and to make more money, yet most jobs in the U.S. require a CTE education and associated certification. We must establish the nation's commitment to the equality of all workers by recognizing the dignity of their contribution to society.

Revitalize the work-based learning programs: Despite the tremendous benefits associated with work-based learning, it remains a marginal education strategy in the U.S. The nation needs to significantly improve participation in work-based learning programs by removing barriers to company participation and promoting its exposure in secondary education.

Measure performance and involvement in workforce development when awarding construction contracts: As owners recognized the importance of safety, they held their contractors to high standards of safety performance, which helped with long-term improvements in worker health and safety. Owners need to assess construction firms' dedication and commitment to workforce development much like the industry does with safety.

The long-term policies include:

Redefine how we measure the quality of secondary education system by career and college readiness: In terms of preparing graduates of our nation's secondary education system, "career

readiness" and "college readiness" are currently used interchangeably. Although academic proficiency is essential for any post-high school achievement, career readiness is a broader concept than just preparing individuals for university studies. At a minimum, all high school graduates should be career ready. The nation's secondary education system should be provided greater incentive to ensure the career readiness of all high school graduates.

Increase the participation of underrepresented groups in CTE: The groups that represent the greatest opportunity for new workers in the construction industry include women, minorities, and veterans. To increase the numbers of these groups within the construction industry we should increase their presence within secondary and post-secondary CTE programs. This policy helps in recruiting these individuals into construction, but the industry must do a better job of retaining these future professionals with improved worksite conditions and other incentives.

Establish and expand collaboration between industry, education, and government: Industry and business leaders directly feel the challenge of recruiting people in non-managerial roles with required skills, training, and education. To promote CTE in both secondary and post-secondary education levels, the industry has to take an active role promoting industry involvement and investment into our nation's secondary and post-secondary Career and Technical Education (CTE) programs.

Develop more balanced funding between post-secondary Career and Technical Education and University Systems: A sizable portion of public education and workforce funding is not effectively allocated to meet the needs of the national economy. The overall governmental funding received by Career and Technical Education programs across the U.S. has declined over the last decade. As a nation, we should increase funding available to CTE programs most needed by industry through both direct funding, incentive programs, and streamlined governmental funding programs.

This research investigates the macro level policies that help change the direction of workforce development system in the U.S. Further investigations are needed to understand implementation side of these polices. Furthermore, these policies are result of thought process within our research team. Although, the people participated in this research were industry experts involved in workforce development, more engagement of different stakeholders from government agencies and education system can help reach more consensus. This can be achieved by conducting a survey based on the results of this research to measure the level of consensus there is around these policies.

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6 CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

This research has two main purposes. From a micro perspective, this research focuses on the career decision-making process of both future and current workforce. The goals are to examine what factors influencing people to choose a career as craft workers in construction, quantify their relative strengths, and understand the differences based on demographics. From macro perspective, the main goal of this research is to investigate the U.S. workforce development system and to recommend policies that can renew the U.S. workforce development system and overcome the current challenges.

I examines each paper based on its contributions and limitations in the following sections.

First Paper: What motivates young talents to pursue craft careers in construction? : The theory of planned behavior

The first paper tried to answer these three research questions:

4. How do different demographic groups (based on gender, race, age, and work experience) perceive working in the construction industry?
5. How does the support/lack of support of others (e.g. family, spouse/partner, friends, schoolteacher, and school consular) influence the individual's decision to choose a career in the construction industry?
6. How does the individual's perception of the difficulty of entering into the construction industry influence her/his decision to choose a career in construction?

The results indicate that there are differences in perception of different demographic groups about working in the construction industry. As an example, I found in comparison to male, females perceive that working in the construction industry is less mentally challenging. As an another example, as women gain more exposure to the industry, they believe less than men do that working in the construction industry is a respectable career.

Regarding the second question, I found the degree to which family, spouse or partner, friends, schoolteacher, and school counselor encourage people to choose a career in the construction industry has correlation with the intention. However, it seems that the role of familiy, spouse or partner, and friends are more important than others.

Self-confidence under perceived behavioral control construct has a high correlation with self-confidence. This is in accordance with self-efficacy theory considers confidence as a strong predictor of a behavior and intention. More interestingly, as people become more experienced in the construction industry, they become more confident in their abilities to be successful in the construction industry.

Theoretical Implications:

Despite the importance of the issue, there is knowledge gap in literature about factors that are important for the new generations when they make career decision in vocational occupations. It laid groundwork for future researches in the vocational training, human resource management studies in the construction industry. The study also demonstrates the application of Theory of Planned Behavior in the field of construction management.

Practical Implications:

From practical view, the findings of this paper are important because they can guide the construction companies regarding the aspects of the jobs that should be emphasized in their recruitment activities. To keep the young talent in the industry, construction companies should foster a workplace environment, which is compatible as much as possible with the expectations of the new generation.

In addition, our results clearly show the importance of early exposure to construction-related jobs on the attitude and intention of young adults towards working in construction. Just one year of work experience can significantly improve the intention. The practical implication of this finding is to encourage and facilitate the exposure to the industry by providing more on-the-job training opportunities, pre-

apprenticeships, apprenticeship, and pre-apprenticeship programs for young adults, especially in secondary education.

I also found that those who have a high motivation to choose a career in construction industry are also more confident about their future success in the industry. The result is in accordance with the literature. So it becomes critical to increase self-confidence in those young adults who are in the early stages of career selection journey about their abilities. Strategies such as providing on-the-job training, featuring those young adults who are successful in construction to show others they also can become successful, engaging young people in mentorship programs can boost their self-confidence.

Limitations and Future Studies:

The sample of this research is mainly limited to those who were exposed to Career Technical Education (CTE) or participated in construction training programs. Although not all participants have work experience in construction or even know the industry very well, they are somewhat familiar with career opportunities in CTE. Further investigations using the same methodology can be done to understand how young people studying in high school and college without any background in CTE perceive working in the construction industry.

Moreover, the results are based on self-report and participants' perception. We do not have any data about their actual behavior to understand how their perceptions influence their final decisions. Therefore, I heavily rely on prediction of Theory of Planned Behavior, which indicates the intention is highly correlated with the behavior. Nevertheless, in this research I cannot quantify this relation.

Second Paper: Factors Influencing Craftworkers' Motivation to Pursue Careers in the Construction Industry

The second paper tried to answer these three research questions:

4. How does the current workforce perceive working in the construction industry? Is there any difference in their perception based on gender and generation?

5. How does the social support influence the individual's motivation to stay in a career in the construction industry?

6. How does individuals' self-assessment of their ability to become successful in construction influence their decision to stay a career in construction?

To answer the first question, I found that seven components influence the overall attitude: passion for building, learning opportunities, having respectable career, benefits to society, wage, career options and job security. Our study show differences in viewpoints based on gender. Females and males do not perceive some aspects of working in construction similarly. Craftswomen in our sample rate benefits to society, working hours, and having respectable career lower than men. This might be due to the nature of the jobs assigned to women in the industry. Previous Studies shows that the construction industry was not as successful as other male-dominated industries to attract women (National Women's Law Center 2012). Since attracting women to the industry could be one of the remedies of current workforce shortages in the industry, construction companies need to customize their human resource initiatives to attract more women.

In terms of generations, Generation X has a relatively pessimistic attitude towards the industry in several aspects. Since this generation includes the core body of the current workforce in the industry, construction companies must pay special attention to them. Considering the knowledge and skills accumulated in this generation, losing people from this generation could be costly for companies.

Regarding the second question, the results show the decision to stay in the industry is not an isolated decision. This decision is influenced by the social environment around the craft workers. Nevertheless,

there is no any significant difference between influence of different parties (i.e. family, spouse/partner, friends and instructors).

Finally, the effect of perceived behavioral control was examined. Self-confidence is an important factor influencing the intention. If people have more confidence on their abilities to become successful in construction, they are more willing to pursue their career in the industry. Construction companies can design mechanisms to effectively improve self-confidence among their workers. Giving feedback through formal mechanisms such as performance management systems or informal mechanisms such as mentorship programs can be effective ways to ensure craft workers about their abilities and identify possible areas for improvements.

Theoretical Implications:

Although there are some studies examine job motivation issues in construction, few studies investigate the factors underlying craftworkers' intention to continue pursuing their career path in the industries. The main contribution of this paper to the body of knowledge is to shed light on career decision-making process of craftworkers and compare them based on genders and different generations. The results of this study laid groundwork for future researches to understand the role of gender and generation on career decisions in construction.

In addition, most studies in the field of job motivation in construction used traditional motivational theories in psychology. This is the first time, a research in construction management has been applied the Theory of Planned Behavior in this field.

Practical Implications:

The main practical implication of this study is to give the industry clearer image of wants and desires of their craftworkers. If the construction firms want to present more effective human resource

initiatives, they need to understand their workforce. Like other pioneer industries in the U.S., they also need to diversify their policies towards their human assets.

Based on the findings, I recommend that the industry should not underestimate the intrinsic drivers of motivation. Although monetary rewards are important as the results of our study suggest, they are not sufficient to serve as the primary factor to motivate craft workers to work in construction. Main recommendations for construction companies based on this research include fostering a work environment that encourages employees' learning and development, providing jobs that are more meaningful, introducing opportunities to have a flexible career, and emphasizing on job security at work.

Limitations and Future Studies:

One of the limitations to this study is our sample. Most of the participants in this research are those craft workers who were participating in training programs. It is reasonable to assume that those who attend these programs have considered long-term career in construction and have relatively positive perception towards the industry. Further investigations can use the same methodology applied in this research and include those craft workers who had worked in construction and then left the industry to find the jobs in other industries.

Moreover, the results are based on self-report and participants' perception. I do not have any data about their actual behavior to understand how their perceptions influence their decisions. In addition, I did not ask them about their behaviors. It is recommended that in future studies, researchers ask behavioral questions about the activities such as searching jobs, participating in training programs and upgrading their skills, looking for promotions.

Finally, we do not know about the construction companies' perspective on these factors. One complementary study would be to ask the same questions from the HR managers about the factors that they believe are important for career decision-making process. By comparing the results, I could identify the gaps between the employers' and the employees' perceptions.

Third Paper: Factors Influencing Craftworkers' Motivation to Pursue Careers in the Construction Industry

The third paper tried to answer these two research questions:

3. How well does Theory of Planned Behavior explain the career decision-making model for the future and current workforce in construction?

4. In what ways is the career decision-making model of the future workforce different from the model for current workforce?

Regarding the first question, the study proved that the Theory of Planned Behavior could explain considerable amount of variance in intention for both groups. The results indicated that attitude and perceived behavioral control have a high impact on the intention to choose a career in construction for future workforce sample. Interestingly, their top four factors are passion for building, benefit for society, learning opportunities and career promotion, which shape the attitude towards working in construction as a craft professional. For perceived behavioral control, confidence to become a successful craft professional is the most important factor.

For the current workforce, attitude has the highest effect on the individual's intention to continue pursuing a career the in construction industry. However, the subjective norm and perceived behavioral control have low effect on intention. For this group, traditional factors such as career promotion, wages and career options have the highest impact. Although, finding learning opportunities is still among the top four attitudinal factors.

Regarding the second questions, by using the multi-sample Structural Equation Modeling, I proved that the difference between two models are statistically significant.

Theoretical Implications:

For this paper, I fully operationalized the Theory of Planned Behavior. Not only in designing the survey, but also in analyzing and reporting the results I used the framework of TPB. We also applied Structural Equation Modeling, which is an advanced multivariate data analysis.

Based on the results of this part, we developed a career decision model for both the future and the current workforce. As far as I know, this is the first career decision model for construction craft workers. This could be the main theoretical contribution of this study.

Practical Implications:

The results of this study can also help construction companies and the industry to improve their recruitment and retention policies and practices.

The recruitment and retention of a future and current workforce are two significant parts of workforce development. Obviously, training and job placement are critical parts too. These findings show that industry outreach efforts to recruit versus retain should be different. Many industry recruitment materials (e.g. videos and brochures) emphases high wages and career advancement as justifications why individuals should pursue a construction job. These factors are important, but these factors are most important to retain the current workforce rather than to recruit a new workforce. By their nature, recruitment materials should be tailored to the future workforce, which as this study observes should emphasize the passion for building, opportunities to benefit society (e.g. renewal of our nation's infrastructure system), learning opportunities, as well as career advancement.

Limitations and Future Studies:

Like two previous studies, the generalizability of this research could be limited by the sample. In addition the results are based on the self-report, and I did not measure any behavioral indicator. New studies can be implemented by using the same framework with other samples and modified questionnaire, or including observational data.

Fourth Paper: Factors Influencing Craftworkers' Motivation to Pursue Careers in the Construction Industry

The fourth paper tried to answer these three research questions:

4. What are deficiencies and strengths of the current U.S. workforce development system?

5. How does the construction industry stakeholders and workforce participants influence workforce development outcomes?

6. What policies should be adopted to transform the current system into an effective workforce development system that will serve both the needs of the construction industry and the U.S. economy as a whole?

Regarding the first two questions, I organized the policy recommendations by providing the justification for them. In "why" section of each policy, by using the literature and secondary data analysis and arguing some cases, I discussed weaknesses and strengths of the current U.S. workforce development system. In "who" section, I explicitly mentioned to the stakeholders and in "why" section I explain their roles around the issue.

Finally, the main output of this study, was eight policy recommendations along with their relative benefits and costs. For each policy, I provided detailed explanation in "what" section.

Theoretical Implications:

A thorough literature review and secondary data analysis provided a very good body of knowledge around the U.S. workforce development system issues.

Moreover, I use the AHP technique for policymaking. Because the AHP model was complex in terms of pairwise comparisons, I developed a Decision Support System based incomplete pairwise comparison algorithm to make the decision making process shorter, easier, and more accurate.

Practical Implications:

The main contribution of this research is that the results of this research could outline the major steps to initiate the path to make the U.S. workforce development system a global example. I can say that this research was the most practical part of my thesis. Since the results of this study can be directly used by policy makers, government agencies, and business leaders.

Limitations and Future Studies:

This research investigates the macro level policies that help change the direction of workforce development system in the U.S. Further investigations are needed to understand implementation side of these polices. Furthermore, these policies are result of thought process within our research team. Although, the people participated in this research were industry experts involved in workforce development, more engagement of different stakeholders from government agencies and education system can help reach more consensus. This can be achieved by conducting a survey based on the results of this research to measure the level of consensus there is around these policies.

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8 APPENDIX: MOTIVATION SURVEY

CII-RT335-Motivation Survey

Welcome to the Survey on the Factors Influencing Job Selection in the Construction Industry

Introduction section:

The primary purpose of this survey is to understand what factors might potentially influence a person's decision to choose a long term career in the construction industry.

The jobs included in this study are limited ONLY to the construction trades such as boiler maker, carpenter, electrician, heavy equipment operator, instrumentation tech, insulation installer, ironworker, painter, plumber, pipefitter, sheet metal worker, welder, etc.

Your feedback is highly valuable and can help us better understand deficiencies and strengths of the construction industry in attracting new workforce. We realize that your time is valuable and sincerely appreciate your participation in this survey.

We anticipate this survey to take no more than 15 minutes. Your participation is voluntary, anonymous, and confidential. No one except the research team members will be allowed to see any of the answers to the questions. No personal identifying data will be collected in this study. Only group information will be summarized for any presentation and publication of results.

If you have questions about this study you can contact Farzad Minooei or Paul Goodrum (both of the University of Colorado at Boulder) at farzad.minooei@colorado.edu or paul.goodrum@colorado.edu. This research is sponsored by Construction Industry Institute (CII).

Please proceed with the rest of the survey.

Section A

In this section we will ask you a few questions about your demographic background.

Q1 What is your age?

- ❍ 15-18
- ❍ 18-24
- ❍ 25-34
- ❍ 35-44
- ❍ 45-54
- ❍ 55-64
- ❍ 65 or older

Q2 What is your gender?

- ❍ Female
- ❍ Male

Q3 Which state or providence is your primary residence?

US:

- ❍ Alabama
- ❍ Alaska
- ❍ Arizona
- ❍ Arkansas
- ❍ California
- ❍ Colorado
- ❍ Connecticut
- ❍ Delaware
- ❍ Florida
- ❍ Georgia
- ❍ Hawaii
- ❍ Idaho
- ❍ Illinois
- ❍ Indiana
- ❍ Iowa
- ❍ Kansas
- ❍ Kentucky
- ❍ Louisiana
- ❍ Maine
- ❍ Maryland
- ❍ Massachusetts
- ❍ Michigan
- ❍ Minnesota
- ❍ Mississippi
- ❍ Missouri
- ❍ Montana
- ❍ Nebraska
- ❍ Nevada
- ❍ New Hampshire
- ❍ New Jersey
- ❍ New Mexico
- ❍ New York
- ❍ North Carolina
- ❍ North Dakota
- ❍ Ohio
- ❍ Oklahoma
- ❍ Oregon
- ❍ Pennsylvania
- ❍ Rhode Island
- ❍ South Carolina
- ❍ South Dakota
- ❍ Tennessee
- ❍ Texas
- ❍ Utah
- ❍ Vermont
- ❍ Virginia
- ❍ Washington
- ❍ West Virginia
- ❍ Wisconsin
- ❍ Wyoming
- ❍ Washington, D.C.
- ❍ Puerto Rico
- ❍ United States Virgin Islands

Canada:

- ❍ Alberta
- ❍ British Columbia
- ❍ Manitoba
- ❍ New Brunswick
- ❍ Newfoundland and Labrador
- ❍ Nova Scotia
- ❍ Ontario
- ❍ Prince Edward Island
- ❍ Quebec
- ❍ Saskatchewan

Other if outside the US or Canada:

_____

Q4 What is your first language?

- ❍ English
- ❍ Spanish
- ❍ Other _____

Q5 What is your race/ethnicity?
- ❍ White/Caucasian
- ❍ Asian
- ❍ Hispanic/Latino
- ❍ African American
- ❍ Indian American
- ❍ Pacific Islander
- ❍ Other _____

Q6 Which of the following best describes the area you live in?
- ❍ Urban
- ❍ Suburban
- ❍ Rural

Q7 What is your highest level of education?
- ❍ Some high school
- ❍ High school (completion)
- ❍ Vocational/technical school
- ❍ Some college
- ❍ College graduate
- ❍ Post graduate degree
- ❍ Other _____

Q8 Did you take any career and technical education classes or courses related to construction (such as industrial arts, drafting or welding) in your high school?
- ❍ Yes
- ❍ No

Q9 Did you take any career and technical education classes or courses related to other industries (such as automotive, aviation, hospitality or health) in your high school?
- ❍ Yes
- ❍ No

Q10 Currently, I am engaged in the construction industry as a(n):
- ❍ Applicant for a construction craft position
- ❍ Apprentice or craft trainee
- ❍ Credentialed Journeyman Craft Professional
- ❍ Not engaged in construction

Q11 In which industries have you worked? (You can choose more than one industry)

- ❑ Agriculture, Forestry, Fishing and Hunting
- ❑ Mining, Quarrying, and Oil and Gas Extraction
- ❑ Construction
- ❑ Manufacturing
- ❑ Wholesale Trade
- ❑ Retail Trade
- ❑ Transportation and Warehousing
- ❑ Utilities
- ❑ Information
- ❑ Finance and Insurance
- ❑ Real Estate and Rental and Leasing
- ❑ Professional and Business Services
- ❑ Education and Health Services
- ❑ Arts, Entertainment, and Recreation
- ❑ Accommodation and Food Services
- ❑ Military
- ❑ Other Industries _____

Q12 How many years of experience do you have in any construction-related jobs?

- ❍ None
- ❍ Less than 6 months
- ❍ 6 months - 1 year
- ❍ 1 - 2 years
- ❍ 2 - 5 years
- ❍ More than 5 years

Q13 What is your parents' highest level of education?

Your father	**Your mother**
❍ Some high school	Some high school
❍ High school	High school
❍ Vocational/technical school	Vocational/technical school
❍ Some college	Some college
❍ College graduate	College graduate
❍ Master's Degree(MS)	Master's Degree(MS)
❍ Doctoral Degree(PhD)	Doctoral Degree(PhD)
❍ Professional Degree (MD,JD,etc.)	Professional Degree (MD,JD,etc.)
❍ Other _____	Other _____

Q14 Which of the following best characterizes your parents' primary industry? (You can choose more than one industry)

Your father	Your mother
❑ Agriculture, Forestry, Fishing and Hunting	❑ Agriculture, Forestry, Fishing and Hunting
❑ Mining, Quarrying, and Oil and Gas Extraction	❑ Mining, Quarrying, and Oil and Gas Extraction
❑ Construction	❑ Construction
❑ Manufacturing	❑ Manufacturing
❑ Wholesale Trade	❑ Wholesale Trade
❑ Retail Trade	❑ Retail Trade
❑ Transportation and Warehousing	❑ Transportation and Warehousing
❑ Utilities	❑ Utilities
❑ Information	❑ Information
❑ Finance and Insurance	❑ Finance and Insurance
❑ Real Estate and Rental and Leasing	❑ Real Estate and Rental and Leasing
❑ Professional and Business Services	❑ Professional and Business Services
❑ Education and Health Services	❑ Education and Health Services
❑ Arts, Entertainment, and Recreation	❑ Arts, Entertainment, and Recreation
❑ Accommodation and Food Services	❑ Accommodation and Food Services
❑ Military	❑ Military
❑ Other Industries _____	❑ Other Industries _____

Q15 Do you have any siblings or relatives working in a construction-related job?

❍ Yes

❍ No

Section B

In this section, we will ask you a few questions about your motivation to choose to work in the construction industry.

For each of the following questions, please choose an answer that best applies to you.

Q16 It is likely that I will choose a career in the construction industry.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q17 Choosing a career in the construction industry seems like a good idea to me.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Section C

In this section, we will ask you about the potential factors that might influence your attitude towards (i.e. favorable or unfavorable evaluation or appraisal of) choosing to work in the construction industry.

For each of the following questions, please choose an answer that best applies to you.

Q18 The construction industry offers high paying jobs.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q19 The construction industry offers high job security.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q20 There are only <u>a few</u> job opportunities in the construction industry.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q21 The construction industry provides a high chance of career promotion.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q22 The construction industry provides jobs that benefit society.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q23 Working in the construction industry <u>makes it challenging to balance work and personal/family responsibilities.</u>

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q24 The construction industry <u>requires long working hours.</u>

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q25 The construction industry provides different career options to choose from.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q26 The construction industry provides a lot of learning opportunities.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q27 Working in construction is physically tough.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q28 Working in construction is mentally demanding.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q29 Working in the construction industry is a respectable career.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q30 I have a passion for building things.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Section D

In this section, we will ask you about the influence of other people important in your life (e.g. family, friends, teachers, etc.) on your motivation to choose to work in the construction industry.

Q31 Please indicate the degree to which these people encourage you to choose a career in the construction industry:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree	Not Applicable
Family/relatives	❍	❍	❍	❍	❍	❍	❍	❍
Spouse/partner	❍	❍	❍	❍	❍	❍	❍	❍
Friends	❍	❍	❍	❍	❍	❍	❍	❍
School teacher	❍	❍	❍	❍	❍	❍	❍	❍
School counselor	❍	❍	❍	❍	❍	❍	❍	❍
Training program instructor	❍	❍	❍	❍	❍	❍	❍	❍

Section E

In this section, we will ask you questions regarding the presence of factors that might control your decision to choose to work in the construction industry. These factors are not completely under the control of you and can either help or hinder your ability to be successful in construction. Some examples are the availability or lack of information, training programs and etc.

For each of the following questions, please choose an answer that best applies to you.

Q32 It is difficult to get certifications needed for a job in the construction industry.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q33 I know where to go to enroll in construction craft or apprenticeship training programs.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q34 It is difficult to get information about potential careers in the construction industry.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q35 I understand what courses I need to take before I become a credentialed journeyman craft professional.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

Q36 I have confidence in my abilities to be successful in the construction industry.

❍	❍	❍	❍	❍	❍	❍
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

We thank you for your time spent taking this survey.