

성과극대화를 위한 기능인력의 육성 및 활용전략

Development of Metric-Based Two-Tier Work Force Strategy

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Abstract

The construction industry has been experiencing a major challenge in its work force, "the shortage of skilled craft workers." This problem has been caused by several factors such as the poor image of the construction industry, lack of training and education, unclear career path, declining wages, and changing work force demographics. A "step-change" approach called the "Two-Tier Work Force Strategy" has been proposed by the Center for Construction Industry Studies (CCIS) to deal with the work force related issues in a radical way. It is composed of two separate strategies, Tier I and II. The Tier I strategy uses less skilled and task trained craft workers, and has a larger administrative site management team than the Tier II strategy. The Tier II strategy utilizes fewer, better-educated, and higher skilled workers who perform some lower-management functions in addition to craft functions. They are paid more, but produce more through higher skills, stay on the job longer through multi-skilling, and deliver improved project performance in safety, quality, schedule, and cost. The Two-Tier Work Force Strategy has the potential to resolve the current work force problems and foster a better work force environment in the future.

Key Words: Shortage of Skilled Craft Workers, Two-Tier Work Force Strategy, Tier I Strategy, Tier II Strategy

1. Introduction

The work force is perhaps the most valuable asset in the construction industry. Most of the construction tasks are completed by craft workers and labor cost comprises about 30% of the total project cost. Field labor is the most volatile element of a project and can significantly influence project cost, schedule, and quality. Safety of labor is also a critical factor for project success. However, there has been little emphasis on the importance of the work force and little effort has been exerted to attract, retain, manage, and develop human capital in the construction industry. As the result, the construction industry is now facing a major challenge, "the shortage of skilled craft workers."

This problem has been caused by several factors such as the poor image of the industry, lack of training and education, unclear career paths, declining real wages, changing work force demographics, and the changing economic and educational circumstances. These issues have been discussed since the late 1980s and many initiatives have been attempted to address the problem. However, those efforts were not enough to prevent the current work force problems. Since the industry did not know exactly what to do, the challenges of work force related issues still remain.

A "step-change" approach is needed to deal with work force related issues in a radical way. A strategy called the "Two-Tier Work Force Strategy" has been proposed by the Center for Construction Industry Studies (CCIS) Work Force Research Team. It is composed of two separate strategies, Tier I and II, and if successful, should provide a structure for long-term progress toward an improved work force.

2. Background

Many organizations, including the Business Roundtable (BRT), the National Center for Construction Education and Research (NCCER), and the Construction Industry Institute (CII), have recognized recent work force challenges in the U.S. construction industry. The Sloan Center for Construction Industry Studies (CCIS) has extensively researched work force issues since 1997.

2.1 U.S. Construction Industry

The annual value of new construction in U.S. is more than \$800 billion and represents approximately 8% of the Gross Domestic Product (U.S. Census Bureau 2001). The industry consists of about 630,000 companies, 82% of which have fewer than 10 employees. The large companies, having 100 or more employees, total less than 1% of construction establishments (Center to Protect Workers'

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Rights 1998). This fragmentation in the industry has prevented developing industry standards and investing in training.

There are approximately 8.6 million workers in the U.S. construction industry, which are 6.4% of the total U.S. labor force (CPWR 1998).

2.2 Shortage of Skilled Construction Workers

The biggest challenge facing the construction industry is its shortage of skilled craft workers. According to the results of the Business Roundtable survey in 1996, over 60% of the respondents indicated they had encountered a shortage of skilled craft workers, and 75% reported the trend had increased over the past five years (BRT 1997). This problem is a combination of worker shortage in addition to deficient skill levels of craft workers caused by insufficient or outdated training.

The construction work force is getting older and fewer young people are being employed in construction (Gaylor 1997), however, the construction industry is among the top seven industries with rapidly growing employment (BLS: Workforce 2000). To fill new worker opportunities and replace workers as they retire or leave, the industry has to recruit 8% of all new work force entrants (CII 1992) which totals between 200,000 and 250,000 new craft workers each year (BRT 1997).

2.2.1 Poor Image of Construction Industry

The image of the construction industry has degraded for several decades and the unfavorable image has hindered the efforts of recruiting new craft workers into the industry. The image problem in construction comes from many different perceptions. A career in the construction industry has meant a lifetime of hard, dangerous, seasonal, and dirty work with too few holidays and not enough money. Young people view the construction trades as non-technical and unprofessional. The necessity to travel and relocate is also a major contributor for the poor image. This unfavorable image of construction exists not only in the U.S., but worldwide.

2.2.2 Unclear Career Path

Promotional growth opportunities for craft workers are limited in construction and there is little advancement to management positions. A career in construction is inherently unstable and uncertain.

More than half of craft workers usually work in the industry for less than ten years and typical craft workers leave the job at age 36. The desire for a permanent and stable job is one of the primary reasons for leaving the construction industry (CII 1992, 2000).

2.2.3 Lack of Training and Education

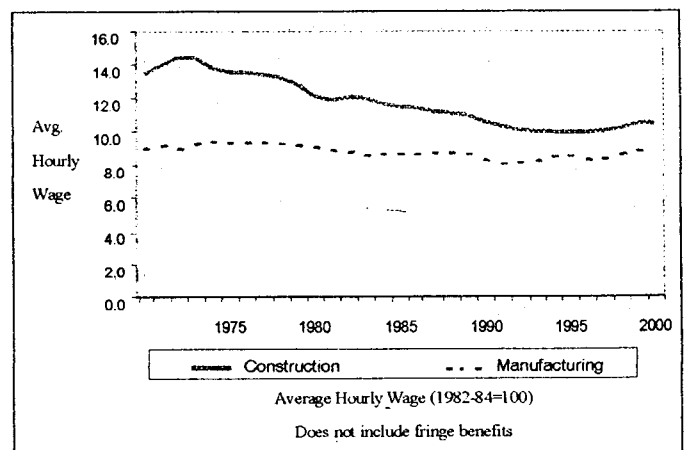
The shortage of skilled workers is often attributed to the lack of training and education opportunities. Clear differences exist in

training philosophies between industry sectors. The union sector has broadly scoped, formal, and well-developed apprenticeship-based training, which represents a high level of investment with a long-term view. Nearly two-thirds of all registered American apprentices belong to construction trades. Construction apprentices receive broad training and develop skills regarding all aspects of a particular trade through rotations lasting between three to five years accompanied by supplemental classroom instruction (CCIS Report No.3 1999).

The open shop sector has been slow to develop training programs despite the advantages demonstrated by union apprenticeship. Some open shop employers have focused on narrow task training, which represents a low investment with a short-term payoff. Large general contractors started training divisions in their own companies in the 1970s and contractor associations organized various programs including "Wheels of Learning", which is now a standard form of training sponsored by the National Center for Construction Education and Research (NCCER). The open shop sector began an initiative to standardize training curriculum on a national basis for the first time through establishment of the NCCER in 1995 (CCIS Report No.3 1999).

2.2.4 Declining Wages

Real wages in construction have dropped faster over the past 30 years than those in other industries. This can be partially attributed to the decline in the union force, which was estimated at 70% during the 1970s and has dropped to an estimated 20% in the 1990s (CPWR 1998). The real wages for construction workers have declined about 25% over the last 25 years as shown in Figure 1 (Hirsch and MacPherson 1997).



Sources: Business Statistics of the United States, Fifth Edition (1999).

Original sources: U.S. Department of Labor, Bureau of Labor Statistics

Figure 1: Wages Comparison in Construction and Manufacturing 1970 - 2000 (Non-supervisory workers)

2.2.5 Changing Work Force Demographics

The traditional construction workers in the U.S. have been white, American, non-Hispanic men who were 76% of construction

production workers in 1996 (CPWR 1998). The most important component of the U.S. construction work force currently is Hispanics and immigrant workers. Hispanic workers are the fastest growing proportion of the construction work force. Workers of Hispanic origin represented 8.9% of wage-and-salary production work force in 1985 and have increased to 14.6% in 1995 (CPWR 1998).

Immigrant workers, including racial minorities and Hispanics, have played an important role in the construction industry in recent years and the industry cannot survive without them. However, the introduction of immigrant and minority workers has contributed to the decline of wages because they are generally less skilled and more willing to accept low wages (Oppendahl 2000).

2.3 Work Force Initiatives

The shortage of skilled workers has been recognized as a major challenge in construction for several years. Many initiatives have been undertaken and research has been performed to solve work force related problems. Most of the efforts have resulted in limited success in the short-term.

2.3.1 Multi-Skilling

With a dwindling work force, the construction industry needs to get more out of its existing work force. Multi-skilling is a labor utilization strategy where workers develop a range of skills appropriate for more than one trade through extensive training. Multi-skilled workers can be used more flexibly on a project or within an organization. The use of multi-skilled workers in which construction personnel are trained in more than one trade has been estimated using data from the CII Model Plant Project. Results of the analysis showed a 35% reduction in the required project work force and a 24% reduction in labor costs as well as a 9% increase in average individual employment duration. Multi-skilled workers could therefore increase their wages and annual earnings (Burlleson 1997).

2.3.2 Impact of Technology on Construction Work Force

The use of computers has advanced the way projects are managed, controlled, and constructed. The computer was initially viewed as a tool for computations and technical or scientific applications; however, it has changed the way construction is executed more than any other technology. (Oberlender 2000). Technological progress has led to new construction processes, methods, materials, and techniques, many of which reduce the need to hire more skilled workers. The new equipment and better knowledge of overcoming nature have also reduced the impact of the seasonal cycles of construction (Oppendahl 2000). In a study of construction productivity, it was discovered that technology has had an impact on productivity gains of construction workers (CCIS Report No.7 1999, Allmon et al. 2000).

2.3.3 High Performance Work System and Organization

The importance of change to a high performance system from a mass production system was emphasized by Ray Marshall (1996, 2000). With the globalization of national economies, global competition cannot be avoided by countries, companies, and people if they want to thrive. Because of global competition, they can compete in only two ways: reduce wages and incomes, or increase value added (i.e. productivity and quality). The only way for those following the low-wage option to improve total incomes is to work more, a reality that clearly limits economic progress. The high-wage, high productivity option, by contrast, could create very steep learning and earning curves, and therefore holds greater promise for personal, organizational, and national advancement. National strategies are necessary to create environments that discourage the low-wage alternative and encourage companies to organize for high performance.

The characteristics of high performance organization according to Ray Marshall (1996, 2000) are as follows: (1) Productivity, Flexibility, and Quality, (2) Worker Participation and Lean Management Systems, (3) High-Order Thinking Skills, (4) Development and Use of Leading-Edge Technology, (5) Positive Incentive Systems, and (6) Workers' Independent Sources of Power.

The construction industry should look at the high performance system to revive in the future.

2.3.4 Self-Managed Work Team

Poor management has often been blamed for inhibiting the productivity of workers due to considerable delay time on site, including rework for design errors, and waiting for materials, tools, equipment, and information. A past study found that poor management was responsible for more than half of the time wasted on a job site (BRT 1983).

The SMWT consists of employees who are responsible for managing and performing technical tasks. Team members are typically responsible for managing most aspects of the work and performing all the technical tasks involved. The team members of SMWT have the authority, as a team, to make decisions about the work and to handle internal processes as they see fit to generate a specific team product, service, or decision. With the given authority, they should have enough knowledge, skill, and ability to perform any given work. Interpersonal processes within and between teams are also important in SMWT including communication, coordination, cooperation, and trust (Yeatts 1998).

SMWT is a very promising approach because fewer workers, increased competition, and fast track projects require employees to provide solutions to typical problems on their own. Construction companies are concerned about availability of skilled trade people to meet their needs and SMWT can be part of a solution.

2.3.5 Communication

Project performance can be enhanced through effective project communications and conversely, a project can fail if hindered by poor communication. Communication problems are apparent and would be worsened if they exist on the project and information does not flow smoothly (Thomas 1996).

Thomas (1996) performed research showing strong and positive correlation between effective communication and project success. Six categories were identified which measure the perceptions of communication effectiveness; Accuracy, Procedures, Barriers, Understanding, Timeliness, Completeness.

Language is the most common barrier to effective communication (Sigband and Bell 1989). A large portion of U.S. work force has been replaced with Mexican workers in recent years and the resulting language problem is a significant concern at construction sites. Also, poor organizational structure with many layers may result in inadequate information flow (Gibson and Hodgetts 1990).

3. Development of Two-Tier Work Force Strategy

3.1 Causes, Effects, and Solutions

Figure 2 shows the causes, effects, and solutions of work force issues in a simplistic way. More money should be invested in the industry for better training and higher compensation of workers. Foreigners, minorities, and women could relieve some burden of the shortage of workers. Technology and automation could reduce the need for skilled construction workers. However, none of these alone can provide the ultimate solution for the work force issues and there should be a "step change" approach including all of these partial solutions.

The construction industry must develop new strategies to attract, retain, maintain, and utilize workers and provide incentives for workers to continue their construction careers.

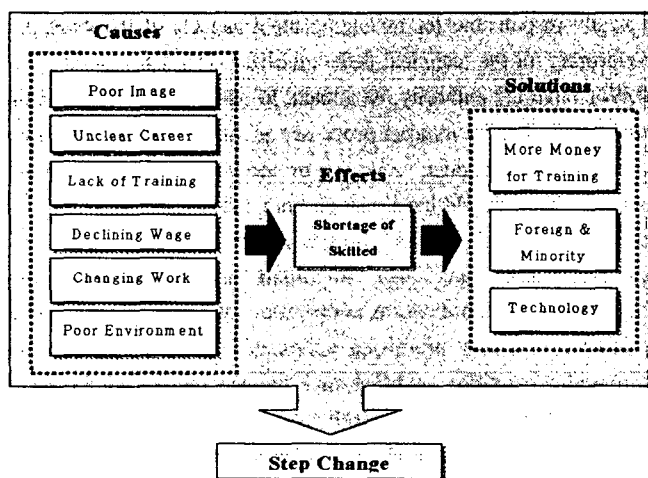


Figure 2: Causes, Effects, and Solutions

3.2 Two-Tier Work Force Strategy

Many initiatives including multi-skilling, technology usage, high performance work team, and enhancement of the industry image have been undertaken to address the problem of the shortage of skilled workers. Since most of the efforts have only resulted in limited short-term improvements, the CCIS work force research team identified the strong need to develop an innovative work force approach in construction and proposed a new concept called a Two-Tier Work Force Strategy.

The concept of the Two-Tier Work Force Strategy has evolved over a number of years, with considerable input from many industry experts and organizations, and based upon numerous earlier research studies, conferences, and initiatives. It is a step-change approach to overcome current work force problems in the construction industry such as the lack of a clear career path, poor industry image, and declining wages, and seeks to address the shortage of skilled workers through a more formalized structuring of the work force. The Two-Tier approach is composed of two distinct work force strategies, Tier I and Tier II.

The construction industry has historically been more dependent on low-skilled labor and resources than on new ideas, skills, and knowledge. Recently, the industry has not been productive and quality driven. Widespread use of overtime is the most common method for workers to increase their income, which is inherently self-limiting. Workers' skill training is typically limited to specific, minimal tasks and workers have little flexibility to perform different jobs on site. Construction companies do not retain workers for a long time and promotion opportunities for workers are limited.

The Tier I Work Force Strategy is similar to the current typical approach of the construction industry as explained above; however, it is different from what the industry uses today in that it has a more formalized structure. The Tier I strategy uses less-skilled and task-trained craft workers, and has a larger administrative site management team than the Tier II strategy. In contrast, the Tier II strategy utilizes fewer, better-educated and higher-skilled workers who also perform some management functions in addition to craft functions. As a result, they receive higher compensation, while delivering projects with improved safety, quality, schedule, and cost performance. The comparison of Tier I and Tier II workers is summarized in Table 1.

Table 1: Two-Tier Workers Comparison

Element	Worker Profil	
	Tier I	Tier II
Workers' Technical Skills	Average	Above Average
Workers' Management Skills	N/A	Selected
Career Path	N/A	Planned
Training	Task Oriented	Multi-skilled
Management Supervision	High	Moderate
Crew Flexibility	Reduce	High

There is no comprehensive strategy of work force management currently in the construction industry. There is only an unstructured work force with some Tier I type workers. However, this will be changed as the new Two-Tier craft system is phased in over time due to the introduction of the Tier I and II strategy as shown in Figure 3. It is hoped that the Tier II workers will comprise most of the construction work force while Tier I workers occupy a small portion of it.

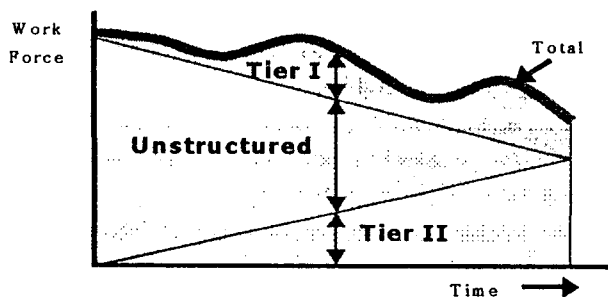


Figure 3: Two-Tier Craft System

The Tier I strategy would be mostly used to accommodate the cyclic nature of construction while maintaining a stable number of Tier II workers. Fewer construction workers would be required due to the higher quality of the Tier II work force. If the Two-Tier Work Force Strategy were successful, it would provide a structure for the long-term development of an improved work force. The hypothetical relationship between the implementation of the Tier I and Tier II strategies and construction success is illustrated in Figure 4. Both Tier I and Tier II strategies have the potential for great construction success if the strategy is chosen and implemented properly. The decision of whether to implement the Tier I or Tier II strategy would be very project specific and governed by many factors including project type, size, location, number of workers on the project, and local labor availability.

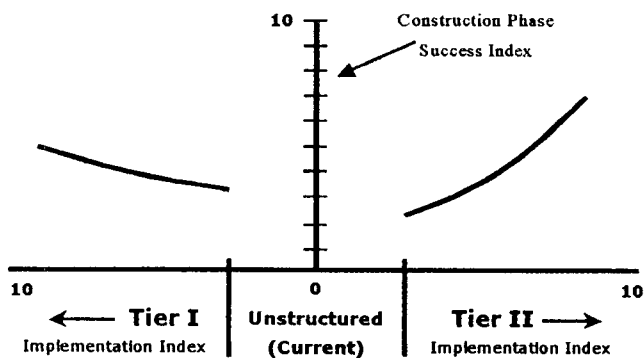


Figure 4: Hypothetical Relationship between Two-Tier Work Force Strategy Implementation and Project Success in Construction Phase

The overall Two-Tier strategy is wide-ranging and requires considerable development. An overriding requirement would be the development of metrics, for measuring the level of implementation of both Tier I and Tier II strategies and also the project success in the construction phase. All three indices would range from 0 to 10

and give a simplified measure of implementation and success on each axis as shown in Figure 4.

3.2.1 Tier I Work Force Strategy

The Tier I strategy is based on a relatively less skilled construction work force. The Tier I workers would, on average, have limited technical skills and experience and they would be paid less than the Tier II workers consistent with their skill levels. Because the Tier I strategy will utilize workers with limited skills and minimal experience, a more detailed management system is essential to employ the workers effectively. Administrative personnel will perform most of the cost management, planning, purchasing, estimating, and scheduling. More training must be provided to overcome limited skills and so, training is most likely limited to project-specific tasks. Entry-level workers are eligible to be Tier I workers and so their loyalty to their company, the project, and the industry is minimal. As a result they can easily move into other industry sectors. However, they also have the opportunity to become Tier II workers. Even with all these features, it should be possible to realize highly successful Tier I projects. Table 2 summarizes the characteristics of the Tier I strategy.

Table 2: Characteristics of Tier I Work Force Strategy

Skills training at today's level (or less) (limited to specific, minimal task)	More detailed supervision (high ratio of supervisor versus craft)
More task training	"White collar" administration (planning, purchasing, scheduling, etc.)
More (less skilled) workers needed	Outside inspection
Relatively low journeyman wages	Entry-level workers & wages
Limited craft flexibility	Minimal worker loyalty to company / project / industry
Shorter retention time (more turnover)	Limited promotion opportunities

The Tier I Work Force Strategy may be applicable to projects in developing countries or U.S. projects that have a high proportion of immigrant or resident alien workers who are low skilled or have English language difficulties, and also on projects where owners cannot be convinced of the merits of the Tier II strategy. It is probable that the Tier I strategy could provide an immediate short-term solution for the shortage of skilled work force. However, the industry should eventually phase into the Tier II strategy to revive.

3.2.2 Tier II Work Force Strategy

The Tier II strategy is based on Tier II workers who have superior technical skills, including multi-skilling, achieved through extensive training and considerable experience. In addition to technical skills, Tier II workers possess some management skills such as administrative, computer, planning, and job management skills. The essence of the Tier II strategy is in the training and

certification of craft workers with support and cooperation from management. The requirements for training and certification give craft workers challenges and once they become certified, they have a better opportunity to advance and continue a career in construction. Workers will be able to progress from apprentices/helpers and journeymen to Tier II workers through an increased emphasis in training and certification.

The Tier II project will require fewer, but better-skilled workers who are expected to produce improved safety, quality, schedule, and cost results compared to current practice. Not all workers on a Tier II project will be Tier II workers. The Tier II workers will receive higher compensation and other benefits corresponding to their skill levels and will experience greater longevity on the project. The peak work force and average number of workers on a Tier II project site will be less than that of today's projects because of the high productivity of the Tier II workers and the resulting reduced turnover. The characteristics of the Tier II strategy are summarized in Table 3.

Table 3: Characteristics of Tier II Work Force Strategy

Higher compensation for workers (wages & duration on site)	Less supervision / Higher worker autonomy
Fewer workers on site (less peak and turnover)	Higher worker loyalty to company / project / industry
Different journeyman/helper mix	Career path opportunities / Longer tenure
Higher worker craft skills (certified)	Appropriate management approach (certified)
Multi-skilled workers (certified)	More craft flexibility
Administration-skilled workers (certified in computers, planning, scheduling, controls, etc)	

A Tier II project will be organized and executed to exploit those advanced Tier II worker skills through information technology, craft worker utilization, and a high performance organization. The organizational structure changes into a flat system giving more responsibility and autonomy in decision-making to the lower levels of the work force because the Tier II workers can handle complicated situations with their additional knowledge and skills. The number of management personnel can be reduced significantly and the crews function as self-managed work teams. As a result of improved compensation and increased duration of employment, workers will develop loyalties to both the project and the company, and furthermore to the industry.

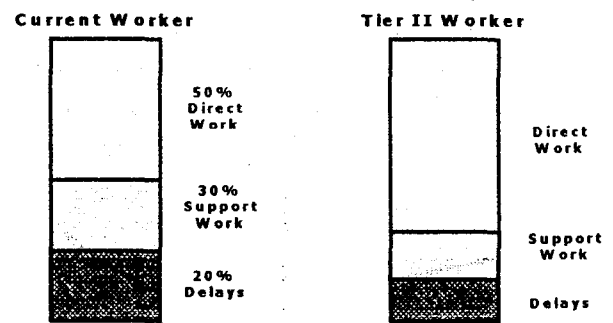
The Tier II Work Force Strategy is a "step-change" approach in the way the construction industry presently organizes for and executes projects. The present efforts surrounding the Tier II strategy are focused exclusively on the construction phase of projects because the strategy is all about improving and then better utilizing the craft work force.

Successful implementation of the Tier II Work Force Strategy will achieve the following objectives at the project level:

- Comparable or better project costs.

- Better quality less rework because of better-skilled workers and improved planning.
- Better safety due to better workers and increased tenure on a project.
- Better schedule resulting from less rework and improved productivity.
- Better productivity due to better-skilled workers, improved planning and scheduling, less rework, better materials management, and improved communication.
- More predictability/less chaos because of better planning and scheduling at the crew level.
- Less administration/supervision reduction in field administrative personnel because more tasks are handled at crew and craft level.
- Fewer workers/less turnover on a project increased use of multi-skilled workers who are able to stay on the project longer and achieve increased performance.

Less attrition of workers as a result of an available career path will benefit the companies and the whole industry as well. Figure 5 shows the comparison of activity between a typical current worker and the Tier II worker. Current workers perform about 50% of total work activity as direct work and about 30% of total work as support work such as transportation of tools and materials, traveling with empty hands, planning, and instructions. About 20% of total work is related to delays including waiting for materials, instructions, crew delay, and personal time. In comparison, the Tier II workers increase direct work by reducing delays because they have the ability to solve problems by themselves. Helpers perform most of the support work.



Source: Tucker, CII AC 2001

Figure 5: Typical Worker Activity

There are necessary steps which must be addressed by industry in order to achieve the Tier II Work Force Strategy.

1. Phase in over time - There should be continuous support from industry including owner, general contractor, and labor associations in order that the Tier II Work Force Strategy can be phased in over the whole industry and become the new standard form of work force management.

2. Establish criteria/agencies for training and certification -

As mentioned before, training and certification is the foundation for the success of the Tier II strategy. There are several different agencies performing training and those agencies could be merged into one or provide standardized curricula together. Union and non-union sectors should work together to achieve this purpose. It would be greatly beneficial for the industry if the workers could have unified standard certifications, which could be used nationwide.

3. Assessment and continuous monitoring of projects - There should be concrete evidence about the effectiveness of the Tier II strategy in order to have the whole industry believe and adopt it. Therefore, it is necessary to assess and monitor actual projects and then find the relationship between the level of implementation and project success.

The basic assumption of the Tier II strategy is that better workers, properly utilized, will produce a more successful construction effort. That assumption is illustrated in the right side of Figure 4 above. This step change in the management of the construction work force from unstructured to Tier II is possible and necessary. The Tier II strategy has great promise to address the shortage of skilled workers by introducing incentives for workers to learn skills and to stay in the construction industry in the long run, and hopefully revive the construction industry in the future.

The suitability index will assess the characteristics of a construction project through adjustment factors such as domestic or international project, geographic project location, industry sector, project type, project size, contract type, local/regional labor availability, number of workers on project, and open shop versus union. It will provide guidance for the decision whether the project is better suited for the Tier I or Tier II strategy.

4. Tier II Work Force Strategy Implementation Index

The critical success factor in the Tier II Work Force Strategy is the development of metrics to measure the level of implementation. The metrics are combined together to make a Tier II Implementation Index. It is intended that the index itself will not only measure the level of implementation but also provide a guide to implementation of the Tier II strategy.

The research model of the Tier II Work Force Strategy Implementation Index is illustrated in Figure 6. At first, individual workers are assessed in their technical and management skills, and then the assessment is used to determine the overall project craft workers' skill levels. After identifying current skill levels of project workers, it is necessary to measure how well the project is executed using the skilled workers in terms of Information Technology Utilization, Craft Utilization, and finally Organizational Changes.

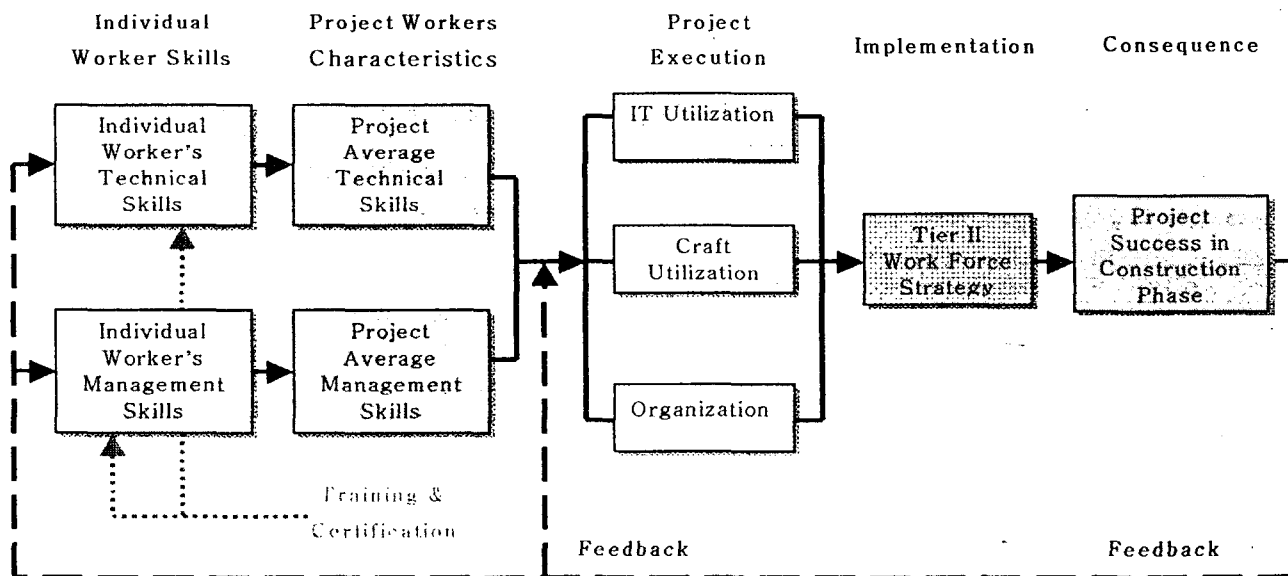


Figure 6: Research Model of Tier II Strategy Implementation Index

3.2.3 Other Considerations in Tier II Work Force Strategy

The construction companies should have a standard to choose between the Tier I and the Tier II strategy. A suitability index will be developed through future research after enough data have been analyzed to determine the difference between the two strategies.

4.1 Composition of Tier II Strategy Implementation Index

The major divisions and categories of the Tier II Strategy Implementation Index are summarized in Table 4 below.

Table 4: Composition of Tier II Strategy Implementation Index

DIVISION I: INDIVIDUAL WORKER SKILLS INDEX	
	1. Individual Worker Technical Skills
	2. Individual Worker Management Skills
DIVISION II: TIER II PROJECT INDEX	
A. PROJECT WORKERS CHARACTERISTICS (capabilities)	
	1. Project Craft Technical Skills
	2. Project Craft Management Skills
B. PROJECT EXECUTION (use of craft worker)	
	1. Information Technology Utilization
	2. Craft Utilization
	3. Organization

The Individual Worker Skills Index assesses the skill level of an individual worker. The Tier II Project Index evaluates overall implementation of the Tier II strategy on a project and is divided into two parts: Project Worker Characteristics and Project Execution. The Project Worker Characteristics part assesses the quality of entire workers on a project. Project Execution part is concerned with the effective use of highly skilled workers in executing the project.

4.2 Individual Worker Skills Index

A Tier II worker must have both superior technical and management skills. The inclusion of management skills is, in itself, a "step-change" in worker expectations and represents a potential career path for ambitious workers.

The Individual Worker Skills Index includes both technical and management skills categories. Each element is measured on a scale of 0 to 10, and weighted such that a maximum score of 100 points is possible for each skills metric. The scores representing individual worker technical skills and management skills will be combined to determine a worker's skill level. The combined score has a maximum value of 200 points. A combined score of 150 points has been decided by discussion among research team members as the minimum score to be qualified as a Tier II worker. Thus, to qualify as a Tier II worker, it is necessary to have both technical and management skills to a significant degree.

- Individual Worker Technical Skills
 - Craft Certification
 - Technical Experience
 - Continuous Training and Education
- Individual Worker Management Skills
 - Administrative
 - Computer
 - Planning
 - Job Management
 - Work Record

4.3 Tier II Project Index

The level of implementation of the Tier II Work Force Strategy on a project is measured through the Tier II Project Index. A Tier II

project, inherently, must have an adequate number of Tier II workers and their high skills and capabilities must be effectively utilized during the project execution. The organization and management should support the Tier II workers in order to achieve the results expected from them.

The index is divided into two parts measuring project worker characteristics and project execution. The project worker characteristics part assesses the skills of workers on a project by craft technical skills and management skills. The project execution part evaluates whether the Tier II workers are used effectively with the three categories of IT utilization, craft utilization, and organization.

Each of the five categories has a maximum value of 100. Each category value is multiplied by a weight determined through the Analytical Hierarchy Process (AHP) and then the values of the five categories are summed. Finally, the sum is divided by 10 to give a maximum Tier II Project Index value of 10.0.

A: Project Workers Characteristics (Capabilities)

- Project Craft Technical Skills
 - Avg. Score from Individual Evaluation on Technical Skills
 - Percentae of Tier II Workers
- Project Craft Management Skills
 - Avg. Score from Individual Evaluation on Management Skills

B: Project Execution (Use of Craft Workers)

- IT Utilization
 - Integrated Information Access
 - Hardware
- Craft Utilization
 - Crew Mix
 - Use of Multi-skilled Workers
 - Worker Turnover
- Organization
 - Communication
 - High Performance Work Place

5. Conclusions

The Tier II Work Force Strategy provides a new formalized structure for work force management in construction, which did not exist previously. It is also a revolutionary approach to revive the construction industry facing the shortage of skilled workers. It will provide the craft workers with career paths and higher compensation through extensive skills training. Eventually the poor image of construction would be improved through the Tier II strategy.

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요 약

미국 건설산업은 숙련된 기능공의 부족이라는 도전적 과제를 경험해 오고 있다. 이 문제는 다음과 같은 여러 원인에 의해 야기된 것이다; 건설산업의 이미지 저하, 훈련과 교육의 부족, 불분명한 경력관리, 임금의 저하, 노동인력의 구성변화. 건설인력과 관련된 이러한 문제점들을 근본적으로 해결하기 위해 Two-Tier Work Force Strategy라는 획기적인 접근방법이 Center for Construction Industry Studies (CCIS)에서 제안되었다. Two-Tier Work Force Strategy는 Tier I과 Tier II Strategy로 구성되어 있다. Tier I 전략은 기술이 떨어지고 단순작업이 가능한 기능인력을 활용하며, 많은 수의 현장관리인원을 필요로 한다. Tier II 전략은 상대적으로 잘 교육받고, 기술수준이 높은 소수의 기능인력을 활용하며, 그들은 기능능력과 더불어 관리능력도 갖추고 있어야 한다. 그들은 더 높은 급여를 받지만, 높은 기술수준으로 인해 더 생산적으로 일할 수 있고, 다중기술의 보유로 더 오래 현장에 머물며, 안전, 품질, 공정, 그리고 원가적 측면에서 향상된 프로젝트 성과를 가져온다. Two-Tier Work Force Strategy는 근래의 기능인력에 대한 문제점을 해결하고, 미래에 더 나은 노동환경을 가져올 수 있는 방안이 될 수 있을 것이다.

키워드: 숙련된 기능공의 부족, Two-Tier Work Force Strategy, Tier I 전략, Tier II 전략