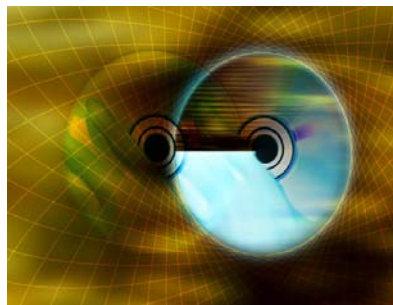


Metro Denver WIRED Initiative Workforce Gaps/Issues Analysis



August 31, 2007

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EXECUTIVE SUMMARY

The U.S. Department of Labor awarded the nine-county Metro Denver region a three-year, \$15 million Workforce Innovation in Regional Economic Development (WIRED) grant in 2006. The Metro Denver WIRED Initiative's goal is to expand the pipeline of locally supplied, highly-skilled workers in the region's fastest growing industries:

- ◆ Aerospace
- ◆ Bioscience
- ◆ Energy
- ◆ Information Technology/Software

The WIRED industries represent four of Metro Denver's highest growth industries. The WIRED industries employ nearly 106,000 workers in over 6,500 businesses in the nine-county WIRED region (Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, Larimer, and Weld counties).

One of the most important factors driving business location decisions is workforce. WIRED industries need to recruit and retain high quality talent to grow and prosper. Each of these studies adds important information in the understanding of the WIRED region's workforce. This gap analysis synthesizes the research conducted through August 2007 by the WIRED Initiative.

This is not a "traditional" gap analysis using workforce supply and demand counts to determine workforce gaps. This report synthesizes the research conducted to this point and highlights the most difficult-to-fill, in-demand occupations, the competencies and skills that are lacking in the WIRED region, and the other workforce issues that prevent businesses from easily attracting the workforce they need.

Research Summary

In order to understand the workforce needs of a region, it is necessary to understand the components of a successful regional workforce:

1. Workforce demand
2. Workforce supply

3. Workforce skills
4. Educational pipeline
5. On-going training
6. Career ladders

A region that has good information related to these six components is armed with the information needed to provide meaningful data to current and prospective employers, assist resident workers in career pursuits, and inform local educational institutions on training needs. The WIRED Initiative's research has addressed each of these components in different ways. Six data sources were used to understand what workforce issues and gaps exist in the nine-county region:

WIRED Workforce Study

The Metro Denver WIRED Workforce Study utilized primary data collection (in the forms of surveying and conducting focus groups) and secondary workforce data to understand the workforce demand and concerns of the four WIRED Industries.

The WIRED Workforce Study is used to determine the most in-demand occupations by industry, skills lacking in the region which require extra training, and other important workforce issues and needs.

Industry Panel Recommendations

Each of the four WIRED industries convened a panel of industry professionals to discuss the most important workforce issues in the region. Each panel compiled a summary of recommendations based on the input of the business professionals over the course of several months.

These recommendations supplement the information presented in the WIRED Workforce Study's identification of high-demand occupations and major industry needs.

Jobs Matrices from the WIRED Panels

The Panel Coordinators assembled a jobs matrix for each of the four WIRED industries. These matrices

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presented the most in-demand occupations and included occupational count, experience and education needed, and level of difficulty to fill.

The Jobs Matrices imparted additional data on the in-demand occupations for each industry. In some cases, quantifiable job counts currently needed were available.

Workforce Competencies

The Workforce Competencies report analyzes the workforce needs of industries based on pre-determined competencies. This study reclassifies the Standard Occupational Classification (SOC) codes into 21 workforce competencies based on skills needed and work performed.

The Workforce Competencies report is used to identify the competencies needed by each WIRED industry and to what level the WIRED region is meeting those needs.

Career Pathways Study

The Career Pathways Study is a review of representative current career pathways in the WIRED Industries. For each industry, major occupational groups were determined and then career ladders within those occupations, related to the industry, were assembled.

The Career Pathways Study is used to understand occupations by industry as well as some basic workforce needs of the WIRED industries.

Asset Map Report

Each of the WIRED Initiative panels (both the industry and supply panels) have worked to identify what workforce and educational assets exist in the WIRED region to help mitigate the gaps in the workforce and create a pipeline of workers that more closely meets the needs of businesses.

The Asset Map Report contain data on graduation rates for science, technology, engineering, and mathematics (STEM) areas in WIRED-region public higher-educational institutions and programs

directed to educate and prepare workforce in the WIRED industries.

Occupational Gaps

In-Demand Occupations

The most in-demand occupations among all four WIRED industries include scientific and technical positions such as engineers, scientists, technicians, and IT workers as well as business and operational occupations such as sales, marketing, and management.

These occupations are in high-demand and difficult-to-fill for WIRED region businesses. Though the Asset Map Report gives a snapshot of current graduates in STEM areas as well as current programs geared towards the WIRED industries, the incoming workforce supply is unclear at this time. What is not in doubt is that these positions are needed now and businesses are challenged to find the qualified workers they need.

Other Gaps and Issues

Competencies Needed

According to the Workforce Competencies report, all four WIRED industries are in need of:

- ◆ Software and IT
- ◆ Management
- ◆ Financial Strategies

Other important competencies to the majority of the WIRED industries include:

- ◆ Engineering
- ◆ Bio-based
- ◆ Industrial Production
- ◆ Sales and Marketing

Though the WIRED region offers strong workforce supplies to support many of these competencies, several areas important to the

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WIRED industries are lacking support including:

- ◆ Bio-based
- ◆ Industrial Production
- ◆ Environmental

Skills Needed

Most important to WIRED businesses are workers with solid foundational STEM skills. Finding workers with the required science, math, and writing skills needed for business is increasingly challenging.

In addition, companies are experiencing gaps in support and soft skills. Workers need training in communications, leadership, and organizational skills as well as basic sales and financial skills in order to succeed.

Other Workforce Issues

The WIRED industries have two major workforce needs apart from occupational and skill gaps:

- ◆ Industry awareness and promotion
- ◆ Connectivity with students and educational institutions

The WIRED industries see the importance of promoting the realities of their industries to the workforce of tomorrow. By working with teachers, counselors, curriculum developers, and the students themselves it will become easier to find workers interested in jobs within WIRED industries. By communicating their needs to educators, businesses may more easily find a workforce with the skills and training needed to succeed in these jobs.

Informational Gaps

The Metro Denver WIRED Initiative has collected a variety of data related to the six workforce components. The demand-side of the workforce equation was well researched but workforce supply information is lacking. In order to create programs that are effective and longest-lasting, the Metro

Denver WIRED Initiative should consider further analysis in a few key areas including understanding workforce supply needs and perceptions and further asset mapping and career ladders.

A great deal of workforce information can be gleaned from the six research studies conducted by the Metro Denver WIRED Initiative. Additional workforce supply analysis would strengthen the WIRED Initiative's position in creating a homegrown, qualified workforce ready to meet the challenges of these key Colorado industries.

INTRODUCTION

In 2006, the U.S. Department of Labor awarded the nine-county Metro Denver region a three-year, \$15 million Workforce Innovation in Regional Economic Development (WIRED) grant. The Metro Denver WIRED Initiative's goal is to expand the pipeline of locally supplied, highly skilled workers in the region's fastest growing industries:

- ◆ Aerospace
- ◆ Bioscience
- ◆ Energy
- ◆ Information Technology/Software

The WIRED industries employ nearly 106,000 workers in over 6,500 companies in the nine-county WIRED region (Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, Larimer, and Weld counties).

The Metro Denver WIRED Initiative has gathered an extensive amount of data on the workforce issues related to the region and the four WIRED industries. This gap analysis synthesizes the research conducted through August 2007 by the WIRED Initiative.

In order to understand the workforce needs of a region, it is necessary to understand the components of a successful regional workforce:

1. Workforce demand
2. Workforce supply
3. Workforce skills
4. Educational pipeline
5. On-going training
6. Career ladders

A region that has good information related to these six components is armed with the information needed to provide meaningful data to current and prospective employers, assist resident workers in career pursuits, and inform local educational institutions on training needs. The WIRED Initiative's research has addressed each of these components in different ways.

This is not a "traditional" gap analysis using workforce supply and demand counts to determine workforce gaps. This report synthesizes the research conducted to this point and highlights the most difficult-to-fill, in-demand occupations, the competencies and skills that are lacking in the WIRED region, and the other workforce issues that prevent businesses from easily attracting the workforce they need.

This report utilizes the research conducted by the Metro Denver WIRED Initiative through August 2007. Six data sources were used to understand what workforce issues and gaps exist in the WIRED region:

- ◆ WIRED Workforce Study
- ◆ Industry Panel Recommendations
- ◆ Job Matrices from the WIRED Panels
- ◆ Workforce Competencies
- ◆ Career Pathways Study
- ◆ Asset Map Report

Each of these studies adds important information to the understanding of the region's workforce.

The report is presented in three parts. The first section is a brief overview of each of the six studies conducted by the WIRED Initiative.

The second component uses information from the studies to identify the most in-demand occupations in each WIRED industry. When available, the demand data is quantified and supplemented with data such as graduation rates and current programs available from the Asset Map Report. Next, competency and skill gaps within the industry are analyzed. This section concludes with an analysis of the most important workforce issues that each industry needs.

The final section of the report discusses the gaps in the current research conducted to this point. It addresses the research limitations and possible routes of further analysis to answer any remaining workforce questions.

RESEARCH SUMMARY

This report summarizes the research conducted by the Metro Denver WIRED Initiative up through August 2007. Six data sources are used to understand what workforce issues and gaps exist in the nine-county region:

- ◆ WIRED Workforce Study
- ◆ Industry Panel Recommendations
- ◆ Job Matrices from the WIRED Panels
- ◆ Workforce Competencies
- ◆ Career Pathways Study
- ◆ Asset Map Report

Workforce Components

Each of these studies adds important information to the understanding of the WIRED region's workforce. The workforce needs of a region may be received and assessed through an understanding of six key workforce components:

1. Workforce demand
2. Workforce supply
3. Workforce skills
4. Educational pipeline
5. On-going training
6. Career ladders

Workforce demand is the jobs required by companies in a region to conduct their business. Data such as employment, occupations, wages, and current and forecasted industry trends create an understanding of the business needs in a region. The research that addresses workforce demand includes:

- ◆ WIRED Workforce Study
- ◆ Industry Panel Recommendations
- ◆ Job Matrices from the WIRED Panels
- ◆ Workforce Competencies

Workforce supply is the amount of labor available in a region to meet its workforce demand. It includes

population, demographic, education, and labor force data to characterize the residents of a region. In other words, workforce demand is a count of jobs whereas workforce supply is a count of people. The research that addresses workforce supply includes:

- ◆ Workforce Competencies
- ◆ Asset Map Report

Workforce skills are those abilities, background, and training that allow workers to succeed in their occupation. Skills can range from soft skills such as communication, organization, and leadership to industry-based skills such as software design and power-line maintenance. Of increasing importance are core science, technology, engineering and mathematics, or STEM skills. These skills, along with writing, business, financial, and marketing skills are needed by most businesses regardless of the occupation. The research that addresses workforce skills includes:

- ◆ WIRED Workforce Study
- ◆ Industry Panel Recommendations
- ◆ Workforce Competencies

The educational pipeline is a combination of the primary, secondary, and post-secondary education institutions preparing students for the working world. A strong educational system imparting the necessary skills and knowledge to the workforce is essential to create workers who are successful in the business world. The research that addresses the educational pipeline includes:

- ◆ WIRED Workforce Study
- ◆ Industry Panel Recommendations
- ◆ Asset Map Report

Education does not end with high school or college. On-going training either on-the-job or by private and public training classes are needed to keep the workforce current on business issues while helping them advance within an organization. The research that addresses on-going training includes:

RESEARCH SUMMARY

- ◆ WIRED Workforce Study
- ◆ Industry Panel Recommendations
- ◆ Workforce Competencies
- ◆ Asset Map Report

A set system of advancement in an organization or industry can help workers identify what skills, experience, and education is required to move to higher levels in an organization. These career ladders help the workforce prepare for their professional careers and are even more important as the baby-boomer generation begins to retire. The research that addresses career ladders is the Career Pathways Study.

An understanding of these six components is required to address the needs of the region's workforce. The WIRED Initiative's research has addressed each of these components in different ways.

Research Overview

WIRED Workforce Study

The Metro Denver WIRED Workforce Study utilized primary data collection (in the forms of surveying and conducting focus groups) and secondary workforce data (from sources such as the Colorado Department of Labor and the U.S. Census Bureau) to understand the workforce demand and issues of the four WIRED Industries. Development Research Partners conducted the study in May 2007.

This report contains basic quantitative data on the businesses and workers in each of the WIRED industries. The survey identifies important information about the skills needed by business, hiring sources used, high-demand occupations, industry perceptions, educational partnerships, and on-going training needs.

This study is used in this report to determine the most in-demand occupations by industry, skills needing extra training in each industry, and to identify other important workforce needs.

The limitation of the WIRED Workforce Study is that it uses predominantly primary data. Businesses were sampled and thus the data can contain sampling error and may not be completely representative of the population. Since the study used a sampling methodology, determining concrete counts of jobs in under-supply within the WIRED region is not possible. Though the report gives workforce demand data, there is little information about the workforce supply.

Industry Panel Recommendations

Each of the four WIRED industries convened a panel of industry professionals to discuss the most important workforce issues faced in the region. Each panel compiled a summary of recommendations based on the input of the business professionals over the course of several months in 2007.

These recommendations are used in this report to supplement the information presented in the WIRED Workforce Study's identification of high-demand occupations and major industry needs.

Similar to the limitations of the WIRED Workforce Study, the Industry Panel Recommendations used primary data and may not be completely representative of all businesses in the WIRED region. In addition, each WIRED industry panel was conducted differently and the recommendations are not presented consistently across each panel.

Jobs Matrices from the WIRED Panels

The Panel Coordinators assembled a jobs matrix for each of the four WIRED industries. These matrices presented the most in-demand occupations and included occupational count, experience and education needed, and level of difficulty to fill.

The Jobs Matrices provided additional data on the in-demand occupations for each industry. In some cases, the number of jobs currently needed was available.

At the time of this report, complete matrices from Aerospace and Energy were available. Partial data was used from the IT and Bioscience matrices.

RESEARCH SUMMARY

Workforce Competencies

The Workforce Competencies report analyzes the workforce needs of industries based on pre-determined competencies. This study reclassifies the Standard Occupational Classification (SOC) codes into 21 workforce competencies based on skills needed and work performed. New Economy Strategies (NES) completed this report in August 2007.

The Workforce Competencies report is used to identify the competencies needed by each WIRED industry and to what level the WIRED region is meeting those needs.

The limitation of this report is that it attempts to link pre-determined industries to the industries determined to be in demand in the Metro Denver WIRED region. Thus, the data do not exactly match the industry definitions used by the Metro Denver WIRED Initiative.

In addition, the report analyzes the level of support the WIRED region gives to needed competencies in an industry. Support for a competency is measured by a region's location quotient (LQ). Competency support is indicated by a location quotient equal to or greater than the national average. A region lacks support for a competency if location quotient is lower than the national average. A location quotient is the concentration of a region's competencies as compared to the national concentration.

The data regarding the competency demand is taken from a national level and compared to the local supply. The limitation of this method is that local competency needs may be different from national needs. These differences may not be taken into account in this analysis.

Career Pathways Study

The Career Pathways Study is a review of representative current career pathways in the WIRED Industries. For each industry, major occupational groups were determined and then career ladders within those occupations were assembled. The Career Pathways study was

completed in August 2007 by the Council for Adult and Experiential Learning (CAEL).

This study is used to understand occupations by industry as well as some basic workforce needs of the WIRED industries.

The limit of the Career Pathways Study is that the study presents a number of career pathways by industry but does not analyze the sample pathways and create a master career pathway to follow. In addition, since the career pathways are assembled from a large number of diverse sources, the data is not consistent from source to source. Further, some important components such as education and salary are missing, in a number of sample career pathways.

Asset Map Report

Each of the WIRED Initiative panels (both the industry and supply panels) have worked to identify what workforce and educational assets exist in the WIRED region to help mitigate the gaps in the workforce and create a pipeline of workers that more closely meets the needs of businesses.

The Asset Map Report contain data on graduation rates for science, technology, engineering, and mathematics (STEM) areas in WIRED-region public higher-educational institutions and programs directed to educate and prepare the workforce in the WIRED industries.

The limit of this data is that the graduation levels are unavailable for private educational institutions (such as the University of Denver and Regis University). In addition, there is no way to link the number of students graduating with STEM-related degrees in the WIRED region public institutions with how many go on to work in WIRED industry jobs. The data was only collected for STEM areas of study and thus many occupational areas needed by industry that are not covered by STEM are not included in this report.

WORKFORCE GAPS

In order to understand the six components of a region's workforce, the gaps in each of the four WIRED industries were analyzed. This report compiled data from the WIRED studies to give a brief overview of each industry, a picture of the most in-demand occupations for that industry, and an analysis of other workforce gap issues related to that industry.

The overview presents counts of employment and businesses and an overview of the major occupational categories in each industry.

The in-demand occupations section identifies the positions and competencies most needed by WIRED businesses. Information on occupational demand is taken predominantly from the Workforce Study, the Panel Recommendations, Jobs Matrices, and the Workforce Competencies Report. Whenever possible, estimates of the number of needed occupations is presented, but the main purpose of this section is to present what occupational and competency areas are most needed in the WIRED region. When available, these high-demand occupations are compared to information from the Asset Map Report including public post-secondary graduation rates relevant to those occupations and current programs related to the industry.

The final component presents the most important workforce issues to each industry. This section uses data from all reports on the skills and competencies lacking in the WIRED industry and other important workforce issues that need to be addressed in order to strengthen the WIRED region's workforce.

Aerospace

The Aerospace industry employs more than 18,000 workers in the WIRED region with an estimated 500 new workers needed each year. According to the Workforce Study, over half of surveyed Aerospace businesses expect to see an increased number of vacancies in high-demand occupations over the next year. Over one-quarter expect to hire at least ten positions over the next year.

There are two major career paths within the Aerospace industry: aeronautics (systems that operate in the Earth's atmosphere) and astronautics (systems that operate above the earth's atmosphere). There are eight major occupational categories within the two career paths:

1. Pilots or crew members of a spacecraft (astronaut, mission specialist, payload specialist)
2. Scientists (several occupations included in three categories of science: physical, life, and social)
3. Mathematicians (computer scientist, mathematician, systems analyst, statistician)
4. Engineers (aerospace/astronautics, chemical, civil, biomedical, computer, electrical, industrial, environmental, materials, mechanical, nuclear, petroleum, plastics, safety, systems)
5. Technicians (electrical, engineering, aerospace model, aircraft, avionics, fabrication, materials, pattern maker/molder)
6. Engineering designers (architectural, electrical, mechanical)
7. Technical communicators (writer, artist, editor, education specialist, public relations, audiovisual specialist, photographer)
8. Other fields (quality control inspector, ground radio operator, teletypist)

Based on the WIRED research four major occupational groupings are especially in-demand for the Metro Denver WIRED Aerospace industry:

- ◆ Engineers
- ◆ Operations and Scientific
- ◆ Manufacturing and Production
- ◆ Business

In-Demand Occupations

Engineers

Identified by the Workforce Study, the Panel Recommendations, and the Jobs Matrix, Aerospace

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businesses in the WIRED region lack engineers. The largest category of in-demand Aerospace occupations are in engineering with Aerospace, Electronics, System, Software and Mechanical engineers the most in-demand. The Panel Recommendations report estimates as much as 58% of in-demand occupations in Aerospace are in engineering. Some of the difficult-to-fill engineering positions include:

- ◆ Aerospace engineers
- ◆ Network engineers
- ◆ Software engineers
- ◆ Mechanical and electrical engineers
- ◆ Systems engineers
- ◆ Antenna design engineers
- ◆ Photogrammetric engineers

These positions usually require at least a bachelor's degree (an estimated 92% require a bachelor's or master's degree) and include all levels of experience, although a higher level of experience is preferred.

According to the Workforce Competencies report, the WIRED region has "very strong support" for engineering competencies. In 2006, 1,281 bachelor's degrees and 501 master's or doctorate degrees were awarded to WIRED-region public-education students in an engineering-related field of study. Of those degrees, 67 bachelor's and 11 master's or doctorate degrees were awarded specifically in Aerospace Engineering Sciences.

Though there appears to be a large number of Colorado graduates with engineering degrees, there continues to be a large need by businesses for engineering positions. There is no data on the percentage of students who graduate from college in Colorado that go on to jobs with Colorado companies.

Operations and Scientific

Operations and Scientific occupations account for as much as 15% of difficult-to-fill positions.

Difficult-to-fill Operations and Scientific occupations in Aerospace are usually in the analysis arena, with a high need for:

- ◆ Business analysts
- ◆ Mission analysts
- ◆ Spacecraft dynamic and static structural analysts
- ◆ Spacecraft thermal analysts

In 2006, 751 public post-secondary students graduated with bachelor's degrees in the sciences and 111 students received master's or doctorate degrees. If 15% of the 500 new positions in Aerospace are in Operations and Scientific occupations, then 75 new Operations and Scientific jobs are needed annually. There seems to be a large number of scientific graduates, but like engineering, there is no data linking graduates to jobs in Colorado and in specific industries. According to Aerospace businesses, there is not the local supply to meet their demand.

Manufacturing and Production

The Aerospace industry is driven primarily by activity in design, management, and research areas but may suffer from shortages in production-level workers. The Workforce Competencies Report shows a lack of support for Aerospace industrial production competencies in the WIRED region, meaning that there is insufficient local supply to meet the demand of a general Aerospace company. Manufacturing and Production occupations are lacking in the WIRED region.

Manufacturing and Production occupations in the WIRED region in high-demand include:

- ◆ Technician
- ◆ Assembly tech
- ◆ Planner
- ◆ Spacecraft assembly and test technician

These positions usually require professional certifications and experience is preferred. No data is

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available on the number of people with professional certifications in the WIRED region.

According to the Workforce Competencies Report, “The Aerospace industry is most likely underserved by production workers, indicating that most activity is in the design, management, and research areas. The Metro Denver WIRED Region’s lack of a seaport has limited its ability to recruit large manufacturers. However, recent relocations of very-light-jet companies will provide the biggest opportunities for new design and production jobs.”

Business

In addition to the scientific and technical occupations in high demand, business occupations are needed for Aerospace companies in the WIRED region. Difficult-to-fill Business occupations with high criticality include:

- ◆ Contracts specialist
- ◆ Proposal specialist
- ◆ Strategic product manager

The Asset Mapping project only collected data on graduation rates for STEM areas of study, and thus there is no information on the incoming pipeline of workers in business occupations in the WIRED region.

Other Gaps and Issues

According to the Workforce Competencies study, the most important competency needed within the Aerospace industry is engineering, followed by industrial production and software and IT. Management and financial strategies competencies are also needed for the industry.

Currently, the WIRED region has “very strong support” for the Aerospace competencies of:

- ◆ Software and IT
- ◆ Financial strategies
- ◆ Engineering

There is “strong support” for management competencies in the region but a lack of support for industrial production in the WIRED region.

In addition to occupational gaps, several skills are lacking in WIRED region Aerospace workers. Specific skills lacking in the WIRED workforce relate to:

- ◆ Systems engineering
- ◆ Data security
- ◆ Photogrammetry
- ◆ Optics
- ◆ Business and soft skills

According to the Asset Map, both Metropolitan State College of Denver and the University of Colorado offer programs specifically devoted to Aerospace careers. Still, the Aerospace industry sees gaps in preparing students for occupations in the industry including:

- ◆ A lack of STEM programs and curriculum for students during primary education
- ◆ A need for more programs connecting students and educators and industry
- ◆ A program to help keep Colorado graduates in the region following graduation

The Aerospace industry’s workforce gaps and needs are broader issues relevant to all WIRED industries. The industry needs ways to promote core skills to students, connect businesses and educational institutions, and promote the hiring of local workers.

Bioscience

The Bioscience industry in the Metro Denver WIRED Region includes nearly 500 companies with over 14,000 employees. The Bioscience industry includes companies involved in pharmaceuticals and biotechnology as well as medical device and instruments.

The Career Pathway report details four major occupational categories:

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1. Engineers
2. High-level scientists
3. Technicians and associates
4. Business and operational staff

Continuing demand for bio-based competencies offers further evidence that the region should view the biotechnology industry as an emerging part of the regional economy. “Bio-based” includes chemical, agricultural, and biological workers, engineers, and scientists.

In-Demand Occupations

Engineers

Engineering is a prime occupation that is challenging to fill. These jobs require at least a bachelor’s degree and several years of experience. Many types of engineers are needed including:

- ◆ Electrical
- ◆ Mechanical
- ◆ Software

In 2006, 1,281 bachelor’s degrees and 501 master’s or doctorate degrees were awarded to Colorado public-education students in an engineering-related field of study. These engineering graduates are shared with other industries (such as Aerospace and Energy) and thus are in high-demand in the WIRED region.

High-Level Scientists

High-level scientific positions usually require a doctorate degree and from three to nine years of experience. These positions are highly specialized and include such titles as:

- ◆ Chemists (analytical and computational)
- ◆ Microbiologists
- ◆ Molecular modeler
- ◆ Medical doctors
- ◆ Toxicology/pharmacology scientists

Of the 751 bachelor’s degrees awarded by public four-year institutions in 2006, 461 were specifically in Biology and 155 in Chemistry. Of the 268 science-related master’s and doctorate degrees awarded in the WIRED region in 2006, 14 were in Biology and 58 were in Chemistry. There is no data available linking graduates with jobs in the Bioscience industry or even within the WIRED region and thus all that can be concluded is that Bioscience businesses are in need of these scientists.

Technicians and Associates

Technicians and associates are in high demand in the Bioscience industry. Most positions require an associate’s or bachelor’s degree and one to five years of experience. Positions in this category include:

- ◆ Research associates
- ◆ Biology associates
- ◆ Histotechnician
- ◆ Repair technicians
- ◆ Clinical lab workers and nurses
- ◆ Manufacturing technicians

In 2006, 257 associate of applied sciences degrees were awarded by public two-year institutions in the WIRED region. There is no trend data available for the degrees and thus it is unclear if graduates are increasing or decreasing, but these positions are in-demand by the industry.

Business and Operational Staff

In addition to scientific positions in high-demand, business and operational positions are a growing challenge to staff for Bioscience businesses. These positions vary greatly in terms of required education and experience. Several major types of positions include:

- ◆ Managers
- ◆ Project managers
- ◆ Sales

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- ◆ Customer service
- ◆ Operational staff

There is no supply data available for business or operations fields. These positions are in high-demand, and according to the Workforce Study and the Panel recommendations, are difficult-to-fill in the WIRED region.

Other Gaps and Issues

Competencies Needed

The Bioscience industry has one of the widest competency breadths of any WIRED industry. According to the Workforce Competencies report, competencies needed by the industry are:

- ◆ Environmental
- ◆ Bio-Based
- ◆ Management
- ◆ Engineering
- ◆ Software and IT
- ◆ Sales and Marketing
- ◆ Content
- ◆ Financial Strategies
- ◆ Back Office

The WIRED region lacks support for two of the nine competencies including:

- ◆ Bio-Based
- ◆ Environmental

This lack of available labor creates the gaps discussed in the in-demand occupations section of this report. There are not enough high-level scientists or technicians to meet the growing demand of Bioscience businesses in the Metro Denver WIRED region.

Skills Needed

Foundation skills in science, math, and communications are the most important workforce characteristics to the Bioscience industry. Project management and manufacturing skills are also highly valued. The Bioscience industry is experiencing a growing demand for workers with specific certifications and high ethical and security standards to meet the needs of their clients.

Other Workforce Issues

In addition to the lack of skills and workers needed, the most important workforce needs for Bioscience businesses surround linking companies with each other and with educational institutions.

The Bioscience industry needs more access, flexibility, and communication from educational institutions. More internship programs, teacher-in-residence programs, and externship programs are important to connect industry with the educational pipeline. Bioscience business leaders would like to work with educational institutions to help increase the knowledge of the industry and its workforce needs to both faculty and students. These strategies would help create a more qualified Bioscience workforce and streamline the hiring process for companies who are already challenged to recruit qualified workers.

Energy

The Energy industry in the Metro Denver WIRED Region employs over 26,600 workers in almost 2,200 companies. The Energy industry accounts for one-quarter of all businesses and one-third of employment within all WIRED industries. The Energy industry encompasses firms conducting business in the generation and transmission of fossil fuels and renewable energy as well as researching and developing innovative energy products and services.

The Energy industry has three major occupational groupings:

1. Scientists (engineers, geologists, and physicists)

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2. Technical workers (technicians, maintenance, and machine operators)
3. Business operations (managers, sales representatives, accountants, etc.)

The Energy industry is in need of workers in each of these three occupation groups.

In-Demand Occupations

Scientists

The largest number of vacancies in the Energy industry within the next year will be in scientific fields, including:

- ◆ Engineers (all types)
- ◆ Geologists
- ◆ Petro physicists (all types)

According to the WIRED Panel Recommendations, engineering positions are difficult-to-fill. As many as 450 engineers and 100 other scientists are needed immediately.

These positions usually require at least a bachelor's degree and a minimum of three years experience. The Energy industry benefits from a high concentration of geological and petroleum technicians, petroleum engineers, and chemists.

These positions are challenging to fill even though a large number of graduates in the sciences enter the workforce each year. Graduates of four-year public higher education institutions totaled 2,032 bachelor's degrees and 855 graduate degrees in the areas of engineering and science in 2006.

Technical workers

Technician positions in-demand include those occupations both inside and in the field. In-demand inside technicians include:

- ◆ Engineering
- ◆ Lab techs
- ◆ Service

- ◆ Manufacturing and maintenance techs

According to the Panel Recommendations Report, as many as 45 technicians are needed immediately.

Educational requirements vary from high school degrees to associate's and bachelor's degrees for technical positions. Experience levels are also varied.

In-demand field technical workers include such occupations as:

- ◆ Commercial Drivers (CDL drivers)
- ◆ Rig hands
- ◆ Linemen
- ◆ Pipeline operators

The Panel Recommendations report identified skilled craftspeople as one of the largest, most difficult occupational groups to currently find with almost 5,500 workers needed immediately.

Educational requirements vary from high school degrees to bachelor's degrees as do experience requirements. These occupations are specialized and require more skill and experience than education and thus there is little information to be gleaned from the Asset Map report.

Business operations

Business occupations are in increasing demand for Energy companies including:

- ◆ Managers
- ◆ Accountants and auditors
- ◆ Landmen
- ◆ Sales

As many as 90 business services professionals are immediately needed in the Energy industry according to the Panel Recommendations report.

Most business positions (save for sales positions) require at least a bachelor's degree. Experience requirements vary from company to company but

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most require at least three years. The Asset Map Report does not provide any information on graduation rates for business bachelor's degrees.

The National Renewable Energy Lab (NREL) currently provides useful assets that connect students to the Energy industry. Programs such as the National High School Science Bowl and the Research Participant Program help promote STEM education and the Energy industry to tomorrow's workforce.

Other Gaps and Issues

Competencies Needed

Energy requires workers with many competencies to conduct their varied operations. The most important competency needed according to the Workforce Competencies report was Environmental. Other competencies needed by the industry are:

- ◆ Engineering
- ◆ Bio-based
- ◆ Industrial production
- ◆ Management
- ◆ Software and IT
- ◆ Trade skills
- ◆ Logistics – Operations
- ◆ Financial Strategies

Of these nine needed competencies, the WIRED region lacks support for:

- ◆ Bio-based
- ◆ Industrial production
- ◆ Environmental

According to the Workforce Competencies study, the Energy industry is supported by most of the competency areas it requires. However, hindering the Resource Extraction industry is a lack of production, environmental, and bio-based workers.

The Colorado School of Mines, University of Colorado, and Colorado State University have strong engineering programs that address these needed competencies, such as bioremediation, environmental aspects of civil engineering, and energy extraction. Additional awareness and expansion of these key programs would support the region's competency requirements.

Skills Needed

The biggest challenge for Energy companies is finding entry-level workers with solid foundation skills. Math and science fundamentals are essential for incoming Energy workers. Basic business and accounting skills are a challenge to find in the workforce.

Craft and technical workers tend to lack sufficient technical skills. Higher-level positions within Energy businesses require more specialized skill sets. The specialized skills most lacking in the region include:

- ◆ Photovoltaic research and development
- ◆ Process technology and instrumentation
- ◆ Project management
- ◆ Genetics
- ◆ Systems engineering
- ◆ Chemical engineering
- ◆ High volume assembly and manufacturing

Other Workforce Issues

The industry would like the WIRED Initiative to assist with linking Energy businesses with education institutions and youth. Externships, input with curriculum development, and youth programs would create a more qualified future workforce in Energy.

The Energy industry sees value in promoting the industry to youth to address misconceptions and help alleviate the challenge of finding enough high-quality workers.

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IT/Software

The Information Technology/Software (IT/Software) industry in the Metro Denver WIRED Region employs nearly 47,000 workers in over 3,800 companies. With 58% of the businesses and 45% of the employment, IT/Software is the largest of the four WIRED industries.

There are three major categories of jobs in the IT industry:

1. Technology workers, which include jobs such as test specialists, consultants, designers, developers, programmers, system engineers, and software engineers
2. Sales and support occupations
3. Management and operations

The technology worker category is one of particular interest to the WIRED initiative. The category is quite complex as it encompasses not only jobs that are in “pure” IT, where the individual works for an IT company that produces or sells computer hardware or software, but also jobs that are in other fields that utilize basic technology and/or computer skills. According to the Workforce Study, almost one-third of all WIRED occupations are in IT.

Based on the research, all three categories of IT jobs have in-demand occupations for the Metro Denver WIRED IT/Software industry.

In-Demand Occupations

Technology workers

Not surprisingly, the largest category of in-demand occupations in the IT/Software industry is in technical positions such as:

- ◆ IT staff/technical support
- ◆ Architects
- ◆ Associates
- ◆ Test specialists
- ◆ Consultants

- ◆ Designers/Developers/Programmers
- ◆ Engineers

Technology positions tend to require a bachelor’s degree and at least three years of experience. In 2006, 329 graduates of public four-year higher educational institutions in the WIRED region received bachelor’s degrees in computer science, engineering, or information systems. Master’s and doctorate degrees in computer science or information systems totaled 175 for public four-year institutions in 2006.

According to the Asset Map Report, almost all four-year higher-education institutions in the WIRED region have programs devoted to computer science, computer engineering, or computer information systems. These educational programs provide instruction for many of the technical skills and competencies needed for the industry. Though there are many programs for technology workers, businesses still struggle to fill these occupations.

Sales and Support

Difficult-to-fill Sales and Support occupations in IT/Software are usually in the analysis arena, with high need of:

- ◆ Sales associates/inside sales
- ◆ Account managers/executives
- ◆ Marketing
- ◆ Customer support

Due to the limitations of the Asset Map Report, there is no information on the numbers of graduates coming out of sales and support programs.

Management and Operations

Management and Operations occupations in the WIRED region in high demand include:

- ◆ Executives
- ◆ Project/program managers
- ◆ Human resources/recruiters

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- ◆ Financial workers/bookkeepers
- ◆ Financial analysts
- ◆ Data workers

This occupational category is not a STEM area and thus there is no Asset Map data available regarding the supply of incoming workers.

Other Gaps and Issues

Competencies Needed

Not surprisingly, the Software and IT workforce competency is the most important to the IT/Software industry according to the Workforce Competencies Report. Other competencies needed by the industry are:

- ◆ Management
- ◆ Sales and Marketing
- ◆ Financial Strategies
- ◆ Artistry
- ◆ Back Office
- ◆ Content

Of these seven needed competencies, the WIRED region has “very strong support” for:

- ◆ Software and IT
- ◆ Financial Strategies
- ◆ Content

Management competencies and Sales and Marketing competencies have “strong support” in the WIRED region. Back Office competencies have support in the region but Artistry competencies have a lack of support.

Skills Needed

In addition to workforce competencies, the IT/Software industry is in need of stronger skills in several areas according to the Workforce Study and the Panel Recommendations. The IT/Software industry has a greater need for strategic IT skills

versus traditional technology skills. The industry panel considered strategic skills development to be its most important workforce need including strengthening local workforce training in:

- ◆ Communication
- ◆ Professionalism
- ◆ Leadership
- ◆ Organization and project management

Employees with strong business and marketing skills are a challenge to find for IT/Software companies. Workers need solid business skills as well as basic working knowledge of technology products and services. Some specific skills include:

- ◆ Sales, especially cold calling
- ◆ Marketing
- ◆ Management

In addition to the support skills in need, the IT/Software industry requires the growth of several computer programming and hardware skills, especially:

- ◆ SQL
- ◆ Java
- ◆ A+

Professionalism and entrepreneurship should be emphasized to students at an early age. This attitude could be improved by offering students hands-on education and internships in the IT/Software industry to give them a sense of work ethic early in their education.

Other Workforce Issues

Apart from advancing workforce skills, the three most important workforce issues according to the Panel Recommendations were:

- ◆ Mitigating the industry perception gap
- ◆ Strengthening internship programs

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- ◆ Assuring the core education of the incoming workforce

IT/Software businesses perceive that the workforce has a negative view of the industry due to its boom and bust past. There is a need for educators to help students understand the many locally available IT/Software jobs. In order to increase the understanding of the industry by youth, businesses need an easy and centralized internship system.

Though the industry has specific technology and support skill requirements, a major need to create a more qualified workforce is to develop the core STEM skills of all students entering the workforce. The workforce lacks basic, foundation skills such as math, science, and writing. These must be strengthened from an early age to prepare the workforce of tomorrow.

Summary

The WIRED industries represent four of Metro Denver's highest growth industries. The four WIRED industries combined include over 6,500 businesses employing nearly 106,000 workers in the WIRED Region. One of the most important factors driving business location decisions is workforce. WIRED industries need to recruit and retain high quality technical and scientific talent to grow and prosper.

In-Demand Occupations

The most in-demand occupations among all four WIRED industries include scientific and technical positions such as engineers, scientists, technicians, and IT workers as well as business and operational occupations such as sales, marketing, and management.

These occupations are in high-demand and difficult-to-fill for WIRED region businesses. Though the Asset Map Report gives a snapshot of current graduates in STEM areas as well as current programs geared towards the WIRED industries, the incoming workforce supply is unclear at this time. What is not in doubt is that the region needs these

positions now and businesses are challenged to find the qualified workers they need.

Other Gaps and Issues

Competencies Needed

According to the Workforce Competencies report, all four WIRED industries are in need of:

- ◆ Software and IT
- ◆ Management
- ◆ Financial Strategies

Other important competencies to the WIRED industries include:

- ◆ Engineering
- ◆ Bio-based
- ◆ Industrial Production
- ◆ Sales and Marketing

Though the WIRED region offers strong workforce supplies and support to many of these occupations, competencies lacking support include:

- ◆ Bio-based
- ◆ Industrial production
- ◆ Environmental

These competencies are important to the WIRED industries and according to the Workforce Competencies report, are lacking in the region.

Skills Needed

Most important to WIRED businesses are workers with solid foundational STEM skills. Finding workers with the science, math, and writing skills needed for business is becoming increasingly challenging.

The Metro Denver WIRED region is also experiencing gaps in support and soft skills. Workers need training in communications, leadership, and organization as well as basic sales and financial knowledge in order to succeed.

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Other Workforce Issues

Overall, the WIRED industries have two major workforce needs apart from occupational and skill gaps:

- ◆ Industry promotion
- ◆ Increased connectivity with students and educational institutions

The industries see the importance of promoting the realities of their industries to the workforce of tomorrow. By working with teachers, counselors, curriculum developers, and the students themselves, it will become easier to find workers interested in jobs within WIRED industries and with the skills and training to succeed in these jobs.

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The Metro Denver WIRED Initiative has collected a variety of data related to the six workforce components. This report does not present a formal workforce gaps analysis. To do so, data would need to be collected on the quantity of workforce supply and demand using secondary data sources and then apply methods such as Ratio or Share gap analysis to determine which occupational areas are in under-supply in the WIRED region. Further research could be conducted to create a formal occupational gaps analysis for the WIRED Industries.

The demand-side of the workforce equation was well researched but workforce supply information is lacking. In order to create programs that are effective and longest-lasting, the Metro Denver WIRED Initiative should consider further analysis in a few key areas.

Workforce Supply Needs and Perceptions

The Metro Denver WIRED Initiative has done a substantial amount of work to understand the demand needs of WIRED businesses. Throughout this process, questions have been posed about the perceptions of students, educators, counselors, parents, and current workers.

In order to develop programs geared at improving the image of WIRED industries and help prepare the workforce to meet the needs of business, it is important to understand the workforce supply needs and perceptions of the WIRED region and its industries directly from educators and the current and incoming workforce.

Issues to be explained by researching the workforce supply may include why workers select certain industries and occupations, what perceived barriers to entry they have regarding certain industries and occupations, and what outreach methods would influence their career decisions.

Further research, such as supply surveying and focus groups, would help to understand the issues, concerns, and perceptions of the workforce supply.

Asset Mapping

The Asset Map Report is the primary source of supply data in the WIRED region. Though the Asset Map Report provide a great deal of information on education and training resources available to the WIRED region workforce, the data is inconsistent between K-12 education, higher education, and industries.

Some of the information included is available only for STEM areas of education and thus there is little information on resources available for other under-supplied occupations, such as business and sales.

Graduation rates, which are only provided for STEM educational areas, are available for 2006 only and thus no information about graduation rate trends can be determined. In addition, the Asset Map Report provides no data on private education enrollment or graduation rates. Overall, there is an incomplete picture of the workforce supply coming from Colorado educational institutions.

The largest challenge for the WIRED industry has been the lack of information linking higher education graduates with professional careers. There is no data or assumptions on the number of graduates from WIRED region institutions securing jobs in the WIRED region. Though there is information on graduation rates for public institutions, there is no way to determine how many graduates will stay in the region. Further, There is no information on which industries the graduates are seeking positions.

Further analysis could be performed on the percentage of Colorado graduates who go on to positions with Colorado companies and in what industry and occupation graduates enter into following school.

Career Ladders

The Career Pathways report gives examples of career ladders for each of the four WIRED Industries. This information could be used to create a master career ladder for the major occupational categories in each industry with information about

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what skills, education, and experience are needed for a worker to advance in the industry.

This type of information could be used to promote industries to youth and clarify misconceptions about salary and advancement for some industries. With the retiring baby-boomer generation, it is essential to have systems in place to prepare the younger workforce to fill spots left by retiring senior employees.

A great deal of workforce information can be gleaned from the six research studies conducted by the Metro Denver WIRED Initiative. Additional workforce supply analysis would strengthen the WIRED Initiative's position in creating a homegrown, qualified workforce ready to meet the challenges of these key Colorado industries.



Economic and Demographic Research

Industry Studies

Fiscal and Economic Impact Analysis

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