



# Metro Denver WIRED Region Workforce Competency Analysis:

## From Clusters of Industry to Clusters of Knowledge & Competency

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## **SECTION ONE:**

### **EXECUTIVE INTRODUCTION**

From Clusters of Industry to  
Clusters of Knowledge & Competency:

Linking Know-What, Know-How,  
and Know-Whom for Competitive Advantage

## **From Clusters of Industry to Clusters of Knowledge & Competency: Linking Know-What, Know-How, and Know-Whom for Competitive Advantage**

While the role of identifying and measuring clusters of industry remains a universal economic development standard, the effects of globalization, outsourcing and offshoring are changing the dynamics of analyzing and therefore designing strategies for communities in transition. Once a standard becomes questioned, it sets in motion a number of alternative means for public and private sector interests to address the future trends in job and wealth creation of local business activity and enterprise formation. The general standard of measuring the aggregation (in economic terms: agglomeration) of employment and wages within an assigned geographic area has, in our engagements and consulting, become a questionable approach to understanding and therefore assessing the tactics for short-term resource allocations and interventions as well as long-term transformation.

What has caused this shift in our approach is not only based on our practical learning in the field, but the confirmation of transitioning corporate operating models and the internal workings of human capital management. We believe that the era of regional clusters of industry as the only model of proving regional competitive advantage is now over and that it is vital for national, state, and regional leaders to embrace strategies that respond to clusters of knowledge and competency.

“ Central to much thinking about how organizations should be restructured for the 21st century is the idea that innovation and growth will depend more and more on so-called knowledge workers, the sort of people who, to quote the title of a recent book...find themselves “Thinking for a Living...” *The Economist, 2006*

This concept of ‘thinking for a living’ confirms not just anecdotal findings from the field but a number of new reports and briefing captured by top business management firms and human resource agencies:

... “In some industries, such as financial services, media, and pharmaceuticals, they (McKinsey) think the share may already be as high as 25% (of the corporate labor force)...” *The Economist, 2006*

Aligned with this shift in recognizing a new form of human capital, corporations and emerging enterprises are framing their competitive structures along networked, distributed models rather than the 19th-20th century fully integrated models. In the U.S., large pharmaceutical companies outsource nearly 65% of their operations, and the defense industry outsources in excess of 70% of its operations. Outsourcing as a business model is now permanent – research, testing and evaluation, and production-manufacturing have long been under pressure to adopt the ‘proximity to the best minds’ approach by locating next to universities, federal laboratories, and places where a certain baseline of demand helps shape product development. It has only been the recent political and media debate about the offshoring of work to international locations that has confused the long-standing evolution of the distributed, networked model with a determination to lower costs due to an array of issues in the U.S. that make for less competitive consumer prices and corporate margins.

**New Economy Strategies asserts that the adoption of a global “hubs and nodes” approach for economic and workforce** development interests at the regional level is now a necessary – not an optional – tactic for responding to these changes within the corporate structure.

Business 2.0, Fortune, Forbes, and BusinessWeek magazines have all begun to capture the emergence of these new responses to globalization, human capital, and reorganization of structures to fit the future. It is telling Business 2.0 alone has run a series that links the best places for work with the future of job characteristics and knowledge: some fifteen new occupations that did not exist three years ago have become the fastest and highest paying positions in the U.S. – disease mapper, gene therapist, etc. (see table below) These are occupations that combine several skills and competencies – sometimes within one person, mainly among a team of knowledge-expertise from various fields and disciplines...and not all requiring a PhD nor post baccalaureate degree!

<b>New Careers and Hot Jobs in the 21<sup>st</sup> Century</b>			
<u>New Careers</u>	<u>Average Salary</u>	<u>Education</u>	<u>Technology</u>
Radio Surgeon	\$200-800K/year	Doctorate	Cyberknife
Info Engineer	\$ 70-120K/year	Associate	Data mining/ analytics
Robot Programmer	\$ 40-100K/year	Associate/4yr	Simulation tools
Disease Mapper	\$ 40-150K/year	PhD	Digital imaging
Hot Jobs: Computer Engineer, Operational Manager, Finance, Health Care, Computer Programmer			
<i>Source: Business 2.0 Magazine</i>			

Political and corporate leaders across the country recognize that a competitive economy requires a competitive workforce above all:

“An educated, well-trained workforce is the key to our state's economic prosperity. We need to take down the no vacancy sign and ensure we are focusing on the needs of both today and tomorrow's employers.” – *Gov. Christine Gregoire, State of Washington*

“If we're going to create the best business climate to create higher paying jobs and retain our young people, we're going to have to build a workforce prepared for the opportunities of the future.” – *Gov. John Hoeven, State of North Dakota*

“The best economic-development tool is a well-educated workforce.” – *Gov. Bill Ritter, State of Colorado*

“Keep your tax incentives and highway interchanges... We will go where the highly skilled people are.” – *Carly Fiorina, past-CEO, HP*

“Soft skills” in the workforce may play an equal – or even bigger – roll in the economy of the future:

“The future differentiator for businesses will lie in the addition and enhancement of “soft skills”...including the techniques and communication styles necessary to facilitate interactions with others in the workplace and around the world. The countries that are best able to successfully cultivate these important skills - along with specific job-related skills - will be the ones who drive the success of global outsourcing.” -- *Global Skills Report, Brainbench Inc., 2006*

“A job can be offshored if the skills needed to perform it are available abroad. Some low-wage countries, especially India, have produced large numbers of highly educated workers who have the skills to do some kinds of offshored technical work, such as engineering. However, although Indian engineers have routine engineering skills, evidence suggests that only some have the non-routine, high-level problem-solving, innovation, and communication skills that are more common among American engineers.” -- *The Brookings Institution, 2007*

Clusters of Knowledge and Competency reach back into global economic history – the Italian crafts and artisans for example fostered a variety of trades and industries around their competencies in leather, metal, and stone. More recently locations such as Puerto Rico and Ireland have leveraged their competencies in the fermentation of rum and whiskey liquors into pharmaceutical drug manufacturing. Long-standing crafts in the distilling of and fermentation for chemical processing were transferable to the potential of other industries. Texas has used its basis in information, software and GIS mapping technologies to reduce the marginal costs of drilling and the reduction of hitting ‘dry-holes’ by applying knowledge in one industry to a dire situation in the advancement of energy production.

Thus, it is no longer about the one or two clusters that demonstrate the largest aggregation of employment and wage growth but the combination of transferable skills, knowledge, talent and competencies – across many opportunities that distinguish sharper focus on the technology and market-maker which defines the region’s advantage. By approaching future analysis and planning around Knowledge and Competencies, regions will be able to minimize the potential shifts in economic fortunes through occupations and sectors in which to express those skills that handle the ebb and flow of cluster dynamics. A case in point, Austin, Texas realized too late that focusing too much on the semiconductor cluster put the fortunes of the region at high risk to the price fluctuations of global manufacturing.

Finally, by focusing on Knowledge and Competencies, a region fosters more pathways for the entire range of its demographic populations, educational attainment, and ultimately aspirations by identifying roles for economic opportunity by becoming a part of a team of expertise – high school, community and technical colleges, four year and advanced research university graduates, industry trained individuals – all serving together around the regional ‘table’ seeking to building several scenarios for stretching the competency strengths in a handful of targets for growth.

*For more discussion on how the knowledge economy has been transformed, see Appendix: “Hubs and Nodes and the Transformation to Clusters of Knowledge & Competency”.*

## **SECTION TWO: EXECUTIVE FINDINGS**

### Workforce Competencies in the Metro Denver WIRED Region

## Executive Findings

This report is entitled “Workforce Competency Analysis” to reflect the transformation from industry strengths to workforce strengths (i.e. competencies) that is now required by new economic systems built on global hubs and nodes. A thorough analysis of the region’s innovation assets would yield a deeper understanding of the region’s “Clusters of Knowledge & Competency”, which are formed when the Know-How, Know-What, and Know-Whom are creatively linked throughout a region. For more information on these concepts, refer to the Appendix: “Hubs and Nodes and the Transformation to Clusters of Knowledge & Competency”.

As one of the best-educated in the country, the Metro Denver workforce has led the Metro Denver WIRED region on an economic course toward technology industries and skilled services. Most of the region’s target industries reflect the contribution of its skilled workforce on the economy:

### Current Target Industries for Metro Denver

- Aerospace
- Aviation\*
- Energy and Renewable Energy
- Biosciences
- Financial Services\*
- Information Technology - Software

*\*Aviation and Financial Services are target industries for the Metro Denver Economic Development Corporation, but are not targets for the Metro Denver WIRED Initiative. The Metro Denver WIRED Initiative’s four target industries (Aerospace, Bioscience, Energy and IT/Software) were identified as having the greatest growth opportunities, coupled with the largest potential for labor shortages. Aviation and Financial Services have been included in this report in order to provide a more aligned picture of the cross-industry competencies that are driving the regional economy.*

Only the local Energy industry reflects the region’s legacy in a resource-based economy, and increasingly this industry is guided by new extraction technologies to access previously unavailable oil, coal, and gas and now renewable technologies that seek to extract energy from new, sustainable sources.

With 38% of adults having a college education, the region is well-positioned to participate in emerging industries within their targets. In many ways, Denver is one of a handful of regions that is leading the charge of a nation gripped by global competition, outsourcing, and technological advancement. However, the region’s educational attainment has come primarily from the relocation of educated workers to the region, not from retaining graduates. Solving the “Colorado Paradox” by building workforce skills and competencies from within is a key focus of the Metro Denver WIRED Initiative for the region.

**Metro Denver WIRED Region’s Worker Profile**

	Total Population	Labor Force	Bachelor’s or higher
WIRED region*	3.14 M	1.74 M	38.0%

\*WIRED region includes the counties of Larimer, Boulder, Jefferson, Adams, Arapahoe, Douglas, Denver, Broomfield, Weld. The WIRED region includes four metropolitan areas: Denver-Aurora metro, Boulder metro, Fort Collins metro, Greeley metro

New Economy Strategies (NES) recognizes that workforce and education lie at the core of a community’s potential. This report aims to help the Metro Denver WIRED Region understand the specific workforce strengths that continue to propel its economy while learning which skills will be required in the future.

The term “competencies” describes groups of skill sets that can apply to any industry or company, such as engineering, management, or marketing. Competencies are another way to look at the occupational structure of a local economy, measuring jobs by skill set instead of industry focus. In fact, today’s workers recognize that industries evolve, die out, or suddenly appear, and individuals have become more accepting of job change and turnover. Competencies can be applied to any number of industries or companies, and we find that even companies themselves are defining core competencies beyond traditional product lines.

A **Workforce Competency Analysis** follows an analytical path that drives to the core of a region’s strengths and its sustainable competitiveness:

- First, what is the Occupational snapshot of my region?
- Which occupations are strong for my region?
- What are the occupational requirements of my region’s industries, both current and in the future?
- What talents or competencies in my region are responsible for the competitiveness of my industry clusters?
- Will these competencies become more or less important in the future?
- What education programs are required to boost our desired competencies?
- Finally, what new or emerging industries could be supported by our regional competencies?

Ultimately, a competency analysis aims to assist strategic planning efforts to:

- Refine existing target lists to companies requiring the existing competencies in the region
- Market the region based on its unique competencies
- Expand post-secondary education pathways programs around competencies needed in the future
- Assist local companies in aligning their own competencies with those of the region
- Empower new and emerging industries to tap the existing competencies in the region

**Determining the Metro Denver WIRED Region’s workforce competencies requires an examination of the current strengths of the workforce and how the workforce supports current and future industry requirements.**

Today, the Metro Denver WIRED Region is comprised of over 1.5 million workers that make about 11% more in salary than the average U.S. worker. The Denver population is well-educated overall, and the region’s workforce strengths are found primarily in technical and professional services, such as computer, architectural, operations, and sciences. These occupational groups pay salaries that are above the average wage for the region, and most pay salaries that are above the U.S. average for the group, a further sign that Denver’s workforce operates at the high end of the U.S. economy.

Specific notable technical occupations in the region include aerospace engineers (aerospace), geological technicians and petroleum engineers (energy), computer software and hardware engineers (IT), and chemists and microbiologists (biosciences). See page 12 for detailed breakdown of top occupations for the region and their US ranking and average wage.

When examined in terms of “workforce competencies” the Metro Denver WIRED Region’s workforce shows significant strengths in:

1. **Software & IT\***
2. **Financial**
3. **Engineering**
4. **Marketing**
5. **Management**

*\*See how competencies are defined on page X and also in the Appendix.*

In fact, each one of these workforce competencies has been critical to the region’s leading industries and companies. Software has been critical to many industries, including the design of microprocessor-controlled machinery which is created by workers using software-engineering competencies.

Specific workforce competencies in software and information technologies, management, bio-based, engineering, legal, financial, and medical, are expected to grow the fastest in the region, while back office, operations, and industrial production are large parts of the workforce that will lag regional growth rates. While financial, medical, and legal competencies are expected to grow within the Metro Denver WIRED Region over the next 10 years, their growth rates will actually lag the national growth in these competences, and therefore, they are expected to lose ground relative to the nation. Primarily this trend points to a loss of local competitiveness versus the U.S in these competencies, but it is also a reflection of improving competencies in previously lagging areas of Logistics & Operations and Industrial Production, which bodes well for lower wage workers.

Nearly all target industry clusters for the region require high-end workers in the areas of **Software & IT** and **Engineering**. High-end professionals are also heavily required in the non-technical areas of **Management**, **Finance**, and **Sales & Marketing**. Lower-end positions in **Back Office** are important to service industries such as IT, Financial Services, and Research, but less so to the manufacturing industries, which have greater need for mid-level positions in **Logistics & Operations** and **Industrial Production** workers.

Analysis points to several strengths and gaps in the region:

- The Aerospace industry is driven primarily by activity in the design, management, and research areas but may suffer from shortages in production-level workers. A recent survey of aerospace employers in the region showed that skills such as systems engineering and data security are in high demand. High demand positions include Engineering and craft/trade positions and often employers find applicants from other companies within the aerospace industry and sometimes from other industries such as IT/Software.
- The Healthcare industry in the Metro Denver WIRED Region shows medical personnel in the region are difficult to find.
- The Electronics industry is supported by several regional competencies in management, software, and engineering, but lacks a large manufacturing base.
- The Energy industry is supported by a diverse set of competencies locally, but the recent WIRED workforce survey points to continued lack of available workforce in key high-

demand occupations (scientists, technicians, field personnel, and operations). The Resource Extraction industry specifically may be hindered by a lack of production, environmental, and bio-based workers. The Colorado School of Mines, CU, and CSU have large, strong, diverse and notable engineering programs that have the potential to address competencies, such as bioremediation, environmental aspects of civil engineering, and every form of energy extraction. These programs will continue to deliver a trained workforce that is critical to the Energy industry. The renewable energy sector has been supported by the many research and design competencies within the Energy sector.

- A recent survey of energy companies in the region showcases that the Energy industry is in need of employees with quality fundamental skills in the areas of math, science, business, and technology. The most in-demand Energy occupations fall into three major categories: scientists (engineers and physicists), technical workers (technicians and maintenance), and business operations (managers and sales).
- The region's competencies point to a strong level of support for the Financial Services industry.
- Regional competencies match well with the needs of the IT industry, but a recent survey of the industry in the region points to a continuing hiring need for a range of workers, from technology workers to support workers and managers. The most important skills to IT/Software businesses include programming and hardware, sales and marketing, and communications and leadership.
- 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, but does not include medical-related fields.
- A recent survey of biosciences employers validated that the industry is experiencing a growing demand for workers with specific certifications and high ethical and security standards. Four major occupational categories most in demand by biosciences companies are high-level scientists, engineers, technicians/associates, and business and operational staff.
- Moderate to low competencies in back office would likely be validated by a variety of industries that struggle to find entry-level workers in Denver.

Through this analysis, NES has identified several workforce competencies should be fostered in the region and marketed to future employers. A further drill-down to the competencies within each industry found in Metro Denver WIRED would provide even greater detail to the current strengths of the region. While additional research and input from companies would be required to validate each “industry-competency strength”, NES has identified the following as a starting point for further discussion:

**NES’ Top Industry-Competency -Driven IndustriesStrengths  
found in the Metro Denver WIRED Region**

Energy Engineering & Software	Aerospace Engineering & Software	Software Information Technology
Electronics Design	Financial Strategies	Back Office Support for Finance & IT

One benefit of the workforce competency analysis is the ability to identify emerging industries which could be developed by cross-connecting competencies in one cluster to another. The Metro Denver WIRED Region is well-positioned to apply its competencies to the following industry clusters if it chooses to pursue them: automotive, back office, industrial machinery, legal services, metalworking and non-profits.

The following full report explores the above observations and findings through a step-by-step analysis with many supporting tables. Fundamentally, a workforce competency analysis illuminates the strengths of a region. Prescriptions for improvement will require further investigation from company interviews, innovation asset mapping, and workforce provider facilitation groups.

**SECTION THREE:  
COMPREHENSIVE REPORT**

Workforce Competencies  
in the Metro Denver WIRED Region

[FULL REPORT]

## A Note on Methodology

As with industry clusters, regional economies may be analyzed in terms of their workforce clusters. The unit of measurement remains a “job”, but jobs are analyzed by occupation code (such as *15-1021: Computer Programmers*) instead of industry code (such as *541511: Custom Computer Programming Services*). This allows a better understanding of the strengths and skills of the local workforce, as opposed to the production strengths of local industries that comes through a traditional cluster analysis.

As with industries, occupations can be measured in terms of “location quotients”, whereby the local concentration of an occupation within a region (“regional share” of the local economy) is divided by the occupation’s average concentration throughout the U.S. (“national share”). The result shows whether an occupation is more concentrated locally than in the U.S. (LQ is greater than 1) or less concentrated locally (LQ is below 1).

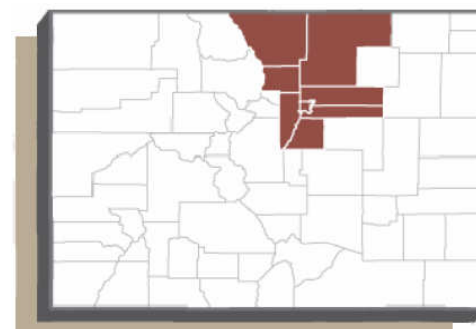
NES has assembled significant regional and national data from the Occupational Employment Statistics database from the U.S. Bureau of Labor Statistics and Colorado Department of Labor and Employment. The BLS provides data on over 700 occupations, including total workers employed in each occupation, the occupation’s average salary, and the occupation’s average salaries for the top 10% of workers. NES has analyzed and enhanced the datasets by calculating LQs across all occupations found within the Metro Denver WIRED Region and calculating Metro Denver WIRED’s rank for each occupation within the 409 U.S. Metros.

To analyze the Metro Denver WIRED Region, NES assembled data for the 4 metropolitan areas within Colorado that fall within the Metro Denver WIRED Region’s boundary:

- Denver-Aurora metro
- Boulder metro
- Fort Collins metro
- Greeley metro

Of the nine counties that are included in the Metro Denver WIRED Region, all are included in the 4-metro aggregation. Four additional non-WIRED counties are included in our analysis that are part of the Denver-Aurora metro (Clear Creek County, Elbert County, Gilpin County, and Park County). However, they are relatively small in comparison to the rest of the WIRED Region (containing less than 1% of the jobs found in the nine WIRED counties). Their inclusion in the 4-metro definition of the “Metro Denver WIRED Region” is necessary in order to minimize the data suppression problems that occur when conducting the analysis on a county-level basis.

### Metro Denver WIRED Region Geography



WIRED counties: Larimer, Boulder, Jefferson, Adams, Arapahoe, Douglas, Denver, Broomfield, Weld

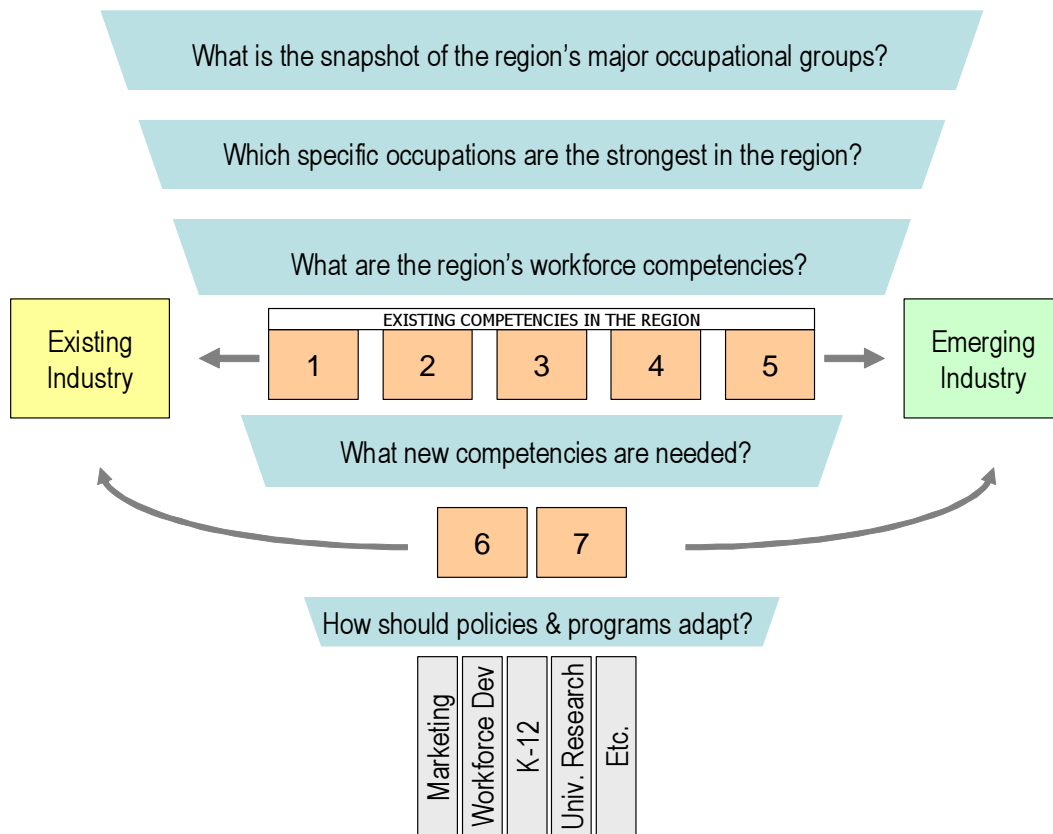
The BLS provides data at several levels of occupational detail:

- **Occupation.** The BLS breaks down the entire US workforce into 733 discrete occupations, categorized according to their SOC code (Standard Occupational Classification).
- **Occupational Major Groups.** Occupations are divided into large groups such as “Life, Physical, and Social Sciences occupations” and “Sales and related occupations” according to function.
- **Occupation Clusters / Workforce Competencies.** Occupation Clusters are more detailed occupation groups that are custom-organized by NES. NES has organized the 733 occupations into 21 separate occupation clusters defined not only by function, but by also by skills, competencies, and education levels (i.e. “workforce competencies”).

NES provides analysis of the Metro Denver WIRED Region’s workforce at each of these three levels of detail. Where available, we provide total employment, average salary, location quotient, and growth projections.

The following diagram demonstrates the analytical process to arrive at workforce competencies in this report:

## Workforce Competency Analysis ANALYTICAL PROCESS



Source: New Economy Strategies, LLC

## Occupational Snapshot of the Metro Denver WIRED Region

Today, the Metro Denver WIRED Region is comprised of over 1.5 million workers making about 11% more in salary than the average U.S. worker. The Denver population is well-educated overall, and the region’s workforce strengths are found primarily in technical and professional services.

Specifically, of the 22 Occupational Major Groups defined by the BLS, the Metro Denver WIRED Region enjoys high concentrations in the following:

- Computer and mathematical occupations
- Life, physical, and social science occupations
- Business and financial operations occupations
- Architecture and engineering occupations
- Legal occupations

### Regional Occupational Composition

Metro Denver WIRED Region\*, 2005

Occupation, sorted by local concentration		Metro Denver WIRED Region				
		Number of Workers	Share of WIRED Economy	Concentration in region (CQ)	Average Regional Salary	Above US OccGroup Salary**
<b>High Concentration (LQ)</b>						
15-0000	Computer and mathematical occupations	59,660	3.9%	1.73	\$72,064	Below
19-0000	Life, physical, and social science occupations	21,800	1.4%	1.58	\$63,381	Above
13-0000	Business and financial operations occupations	84,650	5.6%	1.34	\$61,740	Below
17-0000	Architecture and engineering occupations	33,540	2.2%	1.21	\$65,506	Above
23-0000	Legal occupations	13,810	0.9%	1.20	\$75,597	Above
<b>Average Concentration (LQ)</b>						
11-0000	Management occupations	79,320	5.2%	1.14	\$94,367	Above
47-0000	Construction and extraction occupations	83,550	5.5%	1.13	\$37,732	Below
41-0000	Sales and related occupations	179,820	11.8%	1.11	\$37,585	Below
39-0000	Personal care and service occupations	40,940	2.7%	1.10	\$24,439	Below
27-0000	Arts, design, entertainment, sports, and media	21,390	1.4%	1.09	\$44,789	Below
35-0000	Food preparation and serving related occupations	128,990	8.5%	1.03	\$18,716	Below
43-0000	Office and administrative support occupations	270,900	17.8%	1.02	\$32,613	Below
49-0000	Installation, maintenance, and repair occupations	60,570	4.0%	0.98	\$40,691	Above
37-0000	Building and grounds cleaning and maintenance	49,170	3.2%	0.97	\$22,747	Above
29-0000	Healthcare practitioners and technical occupations	67,120	4.4%	0.88	\$62,395	Above
53-0000	Transportation and material moving occupations	96,450	6.4%	0.86	\$31,863	Below
25-0000	Education, training, and library occupations	78,690	5.2%	0.84	\$43,406	Above
33-0000	Protective service occupations	29,660	2.0%	0.83	\$40,098	Above
21-0000	Community and social services occupations	16,400	1.1%	0.83	\$39,732	Above
<b>Low Concentration (LQ)</b>						
31-0000	Healthcare support occupations	26,220	1.7%	0.67	\$27,823	Below
51-0000	Production occupations	74,710	4.9%	0.63	\$28,210	Below
45-0000	Farming, fishing, and forestry occupations	480	0.0%	0.09	\$25,757	Below
<b>TOTAL WORKERS</b>		1,517,840	100.0%	1.00	\$41,969 Regional	\$37,890 U.S.

\*Includes the metros of Denver-Aurora, Boulder, Fort Collins, and Greeley

\*\*Average salary for Denver WIRED region is \$41,856; the U.S. average is \$37,890

The **Metro Denver WIRED Region's strong occupational groups also pay high wages**. As shown in the above table, the Metro Denver WIRED Region's top 6 occupational groups have average salaries above the regional average (\$41,900). In addition, four of these earn higher average salaries than their peers nationwide. However, computer/mathematical occupations and business/financial occupations currently earn below the U.S. average for their group.

**Occupational groups that are under-performing regional and national salary averages are in labor-intensive occupations.** Occupational groups below both the regional average wage and below the U.S. average include: construction/extraction; sales; personal care; food preparation; office admin support; and transportation. Although the Denver area typically pays higher wages to cover above-average cost of living, these lower skill jobs appear to be below national pay norms. Upgrading the skills and productivity of these workers within their occupation may provide opportunity for salary increases.

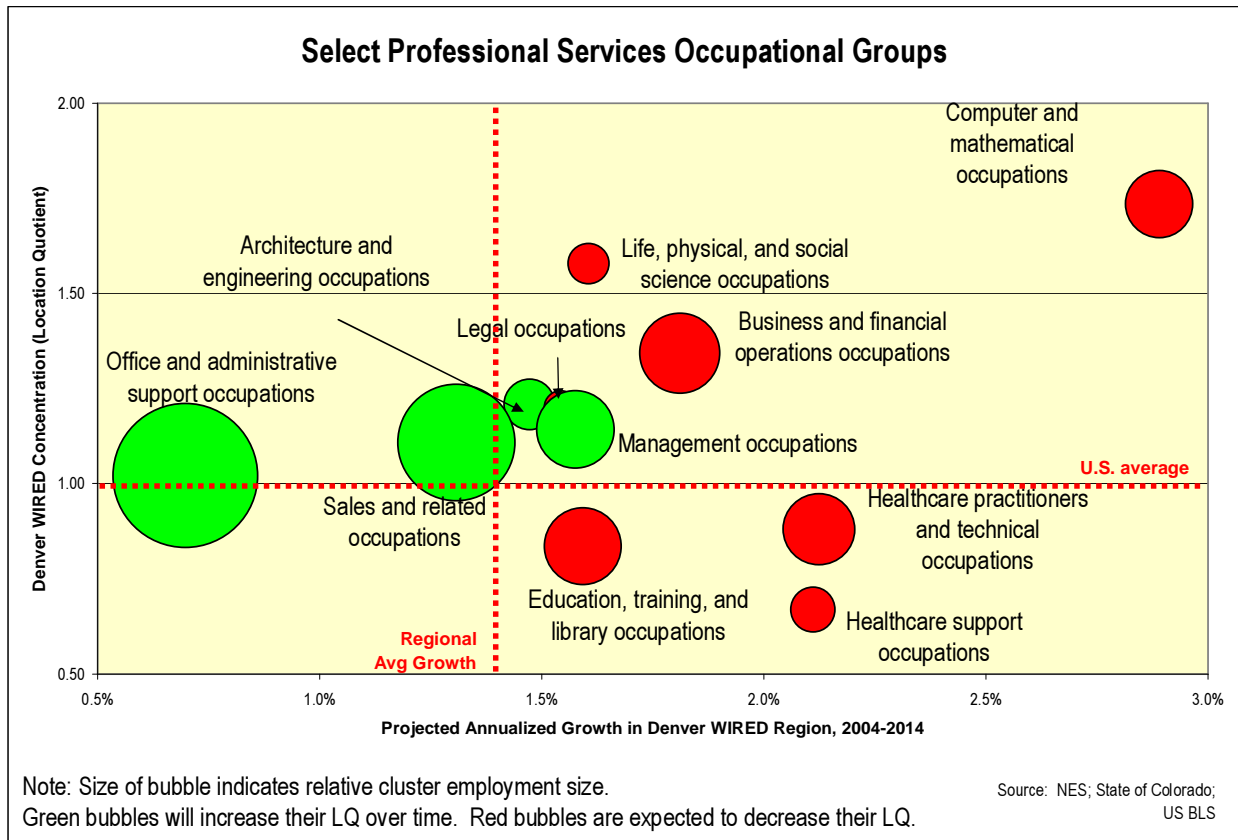
The bubble chart below shows how service occupational groups compare in size, growth, and location quotients:

- **Large service occupation groups (i.e. large bubbles) include:** office/administrative; sales; business/financial; management; and education.
- **Above-average per capita concentrations** (vertical axis showing location quotient for each group) are found in: computer, life sciences\*, business/financial, and architecture/engineering groups, among others.
- Several occupational groups are forecasted by the Colorado Department of Labor and Employment to experience **high growth** in the Metro Denver WIRED Region over the next 10 years (horizontal axis): computers, business/ financial, and health care, among others. Back office administrative and sales occupations are expected to grow the slowest.
- Further analysis by NES shows how occupational groups are growing relative to the rest of the U.S. By comparing forecasted changes in the location quotient of groups, we determine which occupational groups are becoming more concentrated in the region relative to the US. Occupational groups that are expected to increase their location quotient are shown in green (advancing), and groups that have a shrinking LQ are in red (declining).
- **Advancing occupational groups include:** office/admin, sales, architecture/engineering, and management.
- However, the region's leading, high-growth **occupational groups are forecasted to lose their competitiveness** versus the US (actually experiencing shrinking location quotients over time), including computer, life sciences, and business/financial occupations.

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\* "Life sciences" includes life, physical, and social science occupations such as Microbiologists, Chemists, Psychologists, and Environmental Scientists.

- Shrinking local competitiveness versus the US indicates that other regions will see higher growth in these occupational groups and that the Metro Denver WIRED region will see above-average growth in the advancing occupational groups listed above.



## Occupational Strengths in the Metro Denver WIRED Region

The following tables show a breakdown of the top 20 occupations in each of the 4 metros of the Metro Denver WIRED Region according to US size ranking. Ranks are provided for each metro separately for each occupation's location quotient (LQ) and average salary.

### Denver-Aurora, CO Metro -- Top 20 Occupations

By Size Ranking within US, 2005

Occupation	Number / Size			Average Salary	
	US Rank	LQ	Workers	US Rank	Salary
19-2043 Hydrologists	1	5.7	430	11	\$78,700
17-1012 Landscape architects	3	4.4	800	75	\$55,010
17-1021 Cartographers and photogrammetrists	3	5.2	530	11	\$61,060
17-2151 Mining and geological engineers, including mining safety engineers	3	4.1	210	6	\$82,610
13-2021 Appraisers and assessors of real estate	4	2.6	1,510	90	\$52,180
19-2042 Geoscientists, except hydrologists and geographers	4	3.6	900	10	\$91,780
19-4041 Geological and petroleum technicians	5	2.5	250	2	\$60,950
27-2023 Umpires, referees, and other sports officials	5	2.2	250	35	\$19,290
41-2012 Gaming change persons and booth cashiers	5	2.6	660	3	\$24,820
27-2031 Dancers	6	4.3	630	N/A	N/A
49-2022 Telecommunications equipment installers / repairers, except line installers	7	2.7	4,830	72	\$50,180
49-9062 Medical equipment repairers	7	3.2	810	11	\$51,850
51-9131 Photographic process workers	7	2.7	680	76	\$23,330
33-9031 Gaming surveillance officers and gaming investigators	8	2.3	180	3	\$32,050
39-1012 Slot key persons	8	3.2	420	3	\$29,680
53-2011 Airline pilots, copilots, and flight engineers	8	3.5	2,400	13	\$121,340
53-7199 Material moving workers, all other	8	3.0	1,410	111	\$22,320
49-9094 Locksmiths and safe repairers	9	2.6	380	24	\$39,400
17-2171 Petroleum engineers	9	2.4	320	9	\$98,220
41-3099 Sales representatives, services, all other	10	2.5	9,860	75	\$56,510
<b>TOTAL, all workers in Denver-Aurora metro</b>	<b>32</b>	<b>1.0</b>	<b>1,175,160</b>	<b>32</b>	<b>\$42,620</b>

Source: New Economy Strategies; US BLS

N/A: data not available for average wage due to data suppression by the U.S. Bureau of Labor Statistics

Note: Data suppression by the BLS (to protect confidential information at large employers) prevents a breakout of aerospace engineers for the Denver-Aurora metro. Future analysis is anticipated to overcome this current limitation.

### Boulder, CO Metro -- Top 20 Occupations

By Size Ranking within US, 2005

Occupation	Number / Size			Average Salary	
	US Rank	LQ	Workers	US Rank	Salary
19-2012 Physicists	7	30.8	560	54	\$85,850
17-2011 Aerospace engineers	17	2.2	210	32	\$84,210
17-2061 Computer hardware engineers	20	16.7	1,570	2	\$104,110
19-4061 Social science research assistants	26	2.0	40	38	\$30,800
19-4031 Chemical technicians	27	8.2	590	56	\$42,060
19-1022 Microbiologists	29	8.2	150	7	\$78,450
15-1011 Computer and information scientists, research	43	2.9	90	42	\$87,910
27-4099 Media and communication equipment workers, all other	44	3.9	80	67	\$43,080
31-9011 Massage therapists	47	4.0	180	34	\$46,000
11-9121 Natural sciences managers	48	4.1	200	7	\$132,390
29-9091 Athletic trainers	48	2.8	50	15	\$43,350
15-1032 Computer software engineers, systems software	49	4.0	1,520	13	\$96,130
19-4093 Forest and conservation technicians	50	1.1	40	31	\$33,090
15-1031 Computer software engineers, applications	51	4.6	2,510	39	\$83,490
19-2031 Chemists	51	5.2	480	16	\$76,190
25-1199 Postsecondary teachers, all other	51	1.0	330	N/A	N/A
17-3026 Industrial engineering technicians	52	3.2	280	10	\$59,550
15-1099 Computer specialists, all other	57	3.2	450	77	\$61,470
29-1011 Chiropractors	57	3.1	90	127	\$57,300
19-4099 Life, physical, and social science technicians, all other	58	2.7	210	133	\$36,470
<b>TOTAL, all workers in Boulder metro</b>	<b>161</b>	<b>1.0</b>	<b>156,250</b>	<b>13</b>	<b>\$47,440</b>

Source: New Economy Strategies; US BLS

**Fort Collins, CO Metro -- Top 20 Occupations**

By Size Ranking within US, 2005

Occupation		Number / Size			Average Salary	
		US Rank	LQ	Workers	US Rank	Salary
49-9011	Mechanical door repairers	15	3.7	50	51	\$28,080
19-1013	Soil and plant scientists	16	7.3	70	12	\$72,510
19-4093	Forest and conservation technicians	19	4.9	140	34	\$32,680
17-1021	Cartographers and photogrammetrists	21	11.3	120	79	\$37,850
45-2099	Agricultural workers, all other	21	3.5	30	3	\$31,170
19-4021	Biological technicians	31	9.5	600	45	\$36,820
19-1029	Biological scientists, all other	32	6.5	160	9	\$75,290
19-1032	Foresters	35	2.9	30	8	\$65,930
19-1022	Microbiologists	37	5.5	80	27	\$62,120
19-1021	Biochemists and biophysicists	37	1.8	30	48	\$62,360
19-2043	Hydrologists	39	5.1	40	N/A	N/A
35-9099	Food preparation and serving related workers, all other	41	5.2	290	53	\$20,150
47-2082	Tapers	44	4.1	150	107	\$32,600
17-2061	Computer hardware engineers	45	3.6	270	16	\$95,480
17-1012	Landscape architects	47	4.7	90	97	\$51,270
25-1199	Postsecondary teachers, all other	48	1.4	360	95	\$27,000
17-3024	Electro-mechanical technicians	53	2.1	30	41	\$44,740
51-2023	Electromechanical equipment assemblers	58	4.2	230	46	\$30,680
41-9021	Real estate brokers	60	1.8	70	78	\$63,880
19-1042	Medical scientists, except epidemiologists	64	0.9	60	50	\$68,350
<b>TOTAL, All workers in Fort Collins metro</b>		<b>187</b>	<b>1.0</b>	<b>123,290</b>	<b>111</b>	<b>\$37,110</b>

Source: New Economy Strategies; US BLS

**Greeley, CO Metro -- Top 20 Occupations**

By Size Ranking within US, 2005

Occupation		Number / Size			Average Salary	
		US Rank	LQ	Workers	US Rank	Salary
53-2012	Commercial pilots	52	4.3	60	113	\$42,790
49-3041	Farm equipment mechanics	54	4.1	70	65	\$31,170
45-2093	Farmworkers, farm and ranch animals	59	3.2	90	53	\$20,810
25-1081	Education teachers, postsecondary	75	3.5	100	63	\$52,190
13-2021	Appraisers and assessors of real estate	78	2.8	100	195	\$37,950
33-9091	Crossing guards	79	2.8	110	31	\$23,750
51-7041	Sawing machine setters, operators, and tenders, wood	80	2.7	90	78	\$25,050
11-9131	Postmasters and mail superintendents	81	2.7	40	140	\$51,450
51-7042	Woodworking machine setters, operators, and tenders, except sawing	84	3.0	160	128	\$23,750
47-3011	Helpers--brickmasons, blockmasons, stonemasons, and tile/marble setters	85	4.6	150	89	\$27,340
31-9093	Medical equipment preparers	93	3.4	80	54	\$27,320
25-1021	Computer science teachers, postsecondary	97	2.3	50	80	\$57,330
19-4091	Environmental science and protection technicians, including health	99	3.3	60	115	\$35,280
45-2092	Farmworkers and laborers, crop, nursery, and greenhouse	102	0.7	90	192	\$14,900
29-1131	Veterinarians	103	4.1	110	212	\$62,350
43-4031	Court, municipal, and license clerks	104	2.1	120	88	\$30,960
43-5041	Meter readers, utilities	104	1.9	50	62	\$33,750
51-4072	Molding, coremaking, and casting machine setters, operators, and tenders	108	3.0	260	149	\$24,450
43-4141	New accounts clerks	111	2.2	100	104	\$28,850
47-2021	Brickmasons and blockmasons	111	3.2	210	118	\$42,670
<b>TOTAL, All workers in Greeley metro</b>		<b>262</b>	<b>1.0</b>	<b>73,010</b>	<b>178</b>	<b>\$34,870</b>

Source: New Economy Strategies; US BLS

Specific notable technical occupations in the region include aerospace engineers (aerospace), geological technicians and petroleum engineers (energy), computer software and hardware engineers (IT), and chemists and microbiologists (biosciences).

As a side note, the region shows its well educated talent in non-technical areas: landscape architects, foresters, and real estate appraisers.

While it is important to know which occupations are strong within a region, attention should be placed on occupations that are either core or transformative to an industry:

- **Core occupations** are essential to the industry and require specific knowledge and/or skill sets.
- **Transformative occupations** may or may not be part of the core function and may not represent a large portion of employment, but may be instrumental in changing the product or process within the cluster. BLS has identified a number of occupations as “high tech”, which is considered a subset of transformative.<sup>†</sup>
- **Supportive occupations** offer employment in areas that are somewhat ubiquitous in their product, but might be considered as “back office”. These occupations would be important to the functioning of the industry.
- **Other occupations** have little or no relative employment in the previous categories and are considered as such.

As shown in the table below, the Metro Denver WIRED Region has large concentrations in many transformative occupations. **The region has thirty times more physicists per capita than the U.S. and twelve times more computer hardware engineers. Biological technicians and microbiologists** are well-represented in the region, as are geological professions such as **hydrologists, mining and geological engineers, soil and plant scientists, geoscientists, and forest and conservation technicians.** The Energy industry benefits from a high concentration of geological and petroleum technicians, petroleum engineers, and chemists.

IT professionals are also highly concentrated in the region, including **computer software engineers, database administrators, computer support specialists, and network and computer systems administrators.**

**Aerospace engineers and industrial design engineers** are found in high concentrations in the region as well.

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<sup>†</sup> Daniel Hecker, *High Tech Employment, Monthly Labor Review BLS July 2005*

### Top 25 Transformative Occupations in the Denver WIRED Region

Rank	Code	Occupation	Concentration Quotient	Workers
1	19-2012	Physicists	30.8	560
2	17-2061	Computer hardware engineers	12.0	2,290
3	19-2043	Hydrologists	5.6	470
4	19-4021	Biological technicians	5.1	1,260
5	19-1022	Microbiologists	4.9	370
6	19-4031	Chemical technicians	4.6	1,240
7	17-2151	Mining and geological engineers	4.1	210
8	19-1013	Soil and plant scientists	3.8	160
9	19-2042	Geoscientists	3.6	900
10	19-4093	Forest and conservation technicians	2.7	290
11	19-2031	Chemists	2.7	1,170
12	15-1031	Computer software engineers, applications	2.6	11,920
13	17-2051	Civil engineers	2.5	6,480
14	19-4041	Geological and petroleum technicians	2.5	250
15	17-2171	Petroleum engineers	2.4	320
16	27-3042	Technical writers	2.4	1,070
17	17-2081	Environmental engineers	2.4	1,230
18	11-9121	Natural sciences managers	2.3	880
19	17-2072	Electronics engineers, except computer	2.2	2,720
20	17-2011	Aerospace engineers	2.2	210
21	15-1032	Computer software engineers, systems software	2.1	6,460
22	15-1061	Database administrators	2.0	2,100
23	17-3026	Industrial engineering technicians	1.9	930
24	15-1041	Computer support specialists	1.9	10,470
25	15-1071	Network and computer systems administrators	1.8	5,740

Source: New Economy Strategies LLC; US BLS

Note: The “Concentration Quotient” reflects the per capita concentration relative to the U.S. average per capita. A 3.6 “CQ” in geoscientists means that the region has a concentration of geoscientists that is 3.6 times the national average. If the region were identical to the U.S., instead of having 900 geoscientists, the region would have just 250. Concentrations above 2 reflect a strong local competitive advantage.

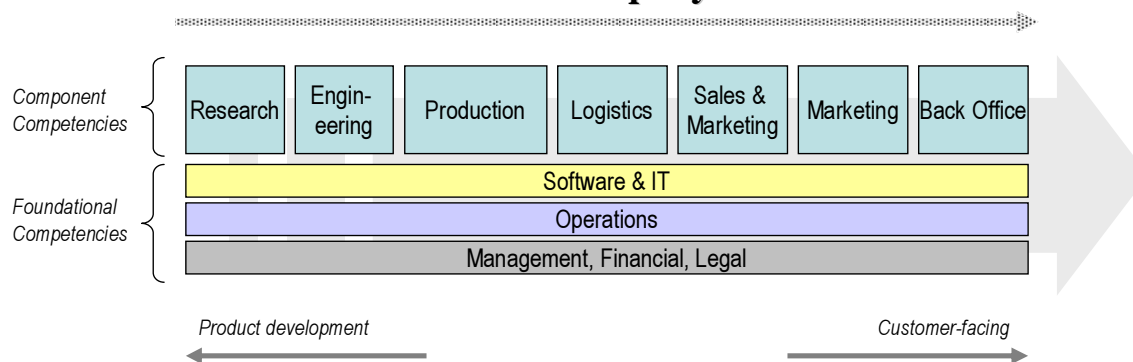
## How are “Workforce Competencies” determined for a region?

While the BLS combines the 733 occupations into 22 major groups, NES has gone a step further by organizing the data into workforce competencies.

We have identified 21 competencies that reflect a specific skillset – independent of the industry in which the worker is employed – to understand where along the industry value chain a region contributes the most to its home companies.

A company’s entire value chain (in this case below, workforce competencies for a pharmaceutical company) starts with product development, which moves into manufacturing, and culminates with client-facing sales and back office operations:

### Example: Workforce Competencies Along the Pharmaceutical Company Value Chain



Each industry would have a variation of the value chain shown above, but the “research-production-sales” continuum can be applied to most manufacturing and services industries regardless of product or market.

As indicated in the diagram, some worker competencies are components within the value chain, while others are foundational and flow throughout the entire value chain of the company (or industry).

The “Clusters of Knowledge & Competency” model was developed by New Economy Strategies in response to changing global conditions that challenge the traditional view of “clusters of industry”. Successful companies and industries are now defined by their distributed, networked business models in which geographic location has been more and more removed as a functional requirement. For instance, the impact of outsourcing as a permanent business model indicates that larger, fully integrated corporate settings are now divested operationally and geographically. Sourcing strategies by companies and their industries is no longer about finding the lowest cost input to be quickly plugged in a production model. Rather, global sourcing is viewed by CEOs as a critical piece of their entire corporate strategy, and flexibility has become the top benefit of a distributed business model, not cost reduction or resource acquisition.

In the opinion of NES, public officials and economic developers should view the global competitiveness in terms of “knowledge & competency”, whereby a region can have a developed cluster in electronics with a competency in engineering and design, while the production occurs

elsewhere in the U.S. or world. Clusters no longer agglomerate within a handful of regions, but operate across a network of global **hubs and nodes**. Given the shift to permanently networked business models, NES believes concentrations of expertise, talent, skills and “**competencies**” are now more valuable to measure and support across the region rather than focusing on cluster development and boosting local supplier gaps.

Analyzing the competencies of a regional economy requires communities to be even more selective in their target list and focusing on competencies within its target industries is the correct choice for policy decisions in marketing, infrastructure, and workforce development.

A competency model helps to define a region’s competitive advantage in new ways by providing further differentiation from a region’s competitors and guiding local institutions away from just an industry-by-industry focus. Competencies should naturally apply to multiple unique industry clusters. A competency in optics can support clusters as diverse as aerospace (laser guidance), medicine (PET scanning), electronics (document imaging), and telecommunications (fiber optic routers). Recognizing the cross-cutting nature of competencies allows us to inject a competency from one local industry into another (e.g. information systems + drug development = bioinformatics), or we can now identify new or emerging industries able to take advantage of local competencies. These become an entirely new set of targets for a region.

*For more information on the Hubs and Nodes model or how Clusters of Knowledge & Competency are analyzed, please refer to the Appendix.*

NES has organized all 733 occupations found in the U.S. into the following 21 competency groups:

### **Workforce Competencies**

1 Management	12 Design
2 Software & IT	13 Environmental
3 Bio-based	14 Legal
4 Medical	15 Governance
5 Engineering	16 Education
6 Logistics - Operations	17 Content
7 Industrial Production	18 Customer Service
8 Sales & Marketing	19 Personal Service
9 Financial Strategies	20 Back Office
10 Artistry	21 Trade Skills
11 Security	

Source: New Economy Strategies, LLC

Workforce competencies are generally defined as follows:

- Management: primarily Chief Executive Officers, general managers, and management analysts
- Software & IT: software programmers and engineers; electronic, telecommunications, and electrical engineers, technicians, and repairers
- Bio-based: agriculture workers/technicians; chemical, materials, nuclear scientists and technicians
- Medical: health care workers only, such as nurses, doctors, home health workers, therapists, and counselors
- Engineering: civil, mechanical, aerospace, nuclear engineers
- Logistics – Operations: laborers, material movers, bookkeepers, purchasing managers, human resource managers, transportation workers
- Industrial Production: production/maintenance workers, industrial engineers, production managers
- Sales & Marketing: telemarketers, sales/marketing managers, real estate brokers
- Financial Strategies: accountants, financial managers, budget analysts, economists
- Artistry: actors, directors, performers, fine artists
- Security: police, fire, security guards, emergency management, corrections officers
- Design: graphics design, furniture/textiles workers and designers, multimedia designers, architects, landscape designers, film and camera operators
- Environmental: environmental/petroleum engineers and workers, geoscientists, hazardous materials workers, conservation specialists
- Legal: lawyers, legal clerks, judges
- Governance: postal workers, legislators
- Education: teachers (primary, secondary, post-secondary)
- Content: writers/editors, public relations, interpreters, printing technicians, museum curators
- Customer Service: retail workers, hotel workers, restaurant workers, gaming workers
- Personal Service: HVAC workers, dry cleaning, home repairers/installers
- Back Office: office workers, data entry, clerks
- Trade Skills: primarily construction workers

[See Appendix for a list of top occupations in each workforce competency group.]

## What are the Workforce Competencies within the Metro Denver WIRED Region?

Having aggregated the occupational data for the four metros within the Metro Denver WIRED Region, NES has summarized how many workers are found in each competency, how concentrated the competency is within the region, and what the average salary is for each competency.

The top five worker competencies within the region are:

1. **Software & IT**
2. **Financial Strategies**
3. **Engineering**
4. **Sales & Marketing**
5. **Management**

“Legal” closely follows. These are the occupational clusters where the Metro Denver WIRED Region has the highest level of specialization.

### Occupational Clusters

Metro Denver WIRED region\*, 2005

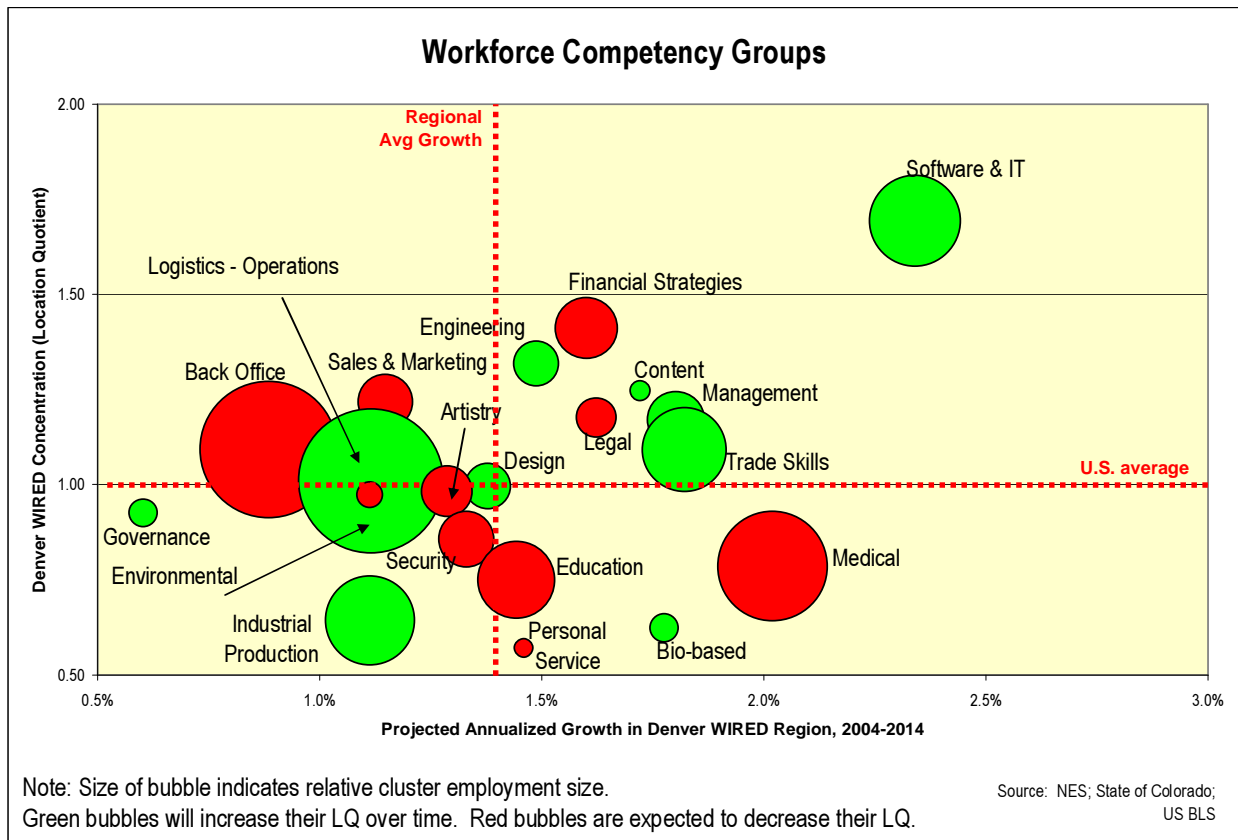
Occupation, sorted by local concentration	Metro Denver WIRED Region				
	Number of Workers	Share of WIRED Economy	Concentration in region (LQ)	Average Salary	Above / Below Avg Salary*
<b>Sorted by High Concentration (LQ)</b>					
Software & IT	82,060	5.7%	1.65	\$70,450	Above
Financial Strategies	38,250	2.7%	1.38	\$70,666	Above
Engineering	20,400	1.4%	1.29	\$71,390	Above
Content	4,090	0.3%	1.24	\$50,970	Above
Sales & Marketing	29,830	2.1%	1.18	\$60,125	Above
Management	33,270	2.3%	1.17	\$102,129	Above
Legal	15,960	1.1%	1.14	\$72,164	Above
Trade Skills	74,470	5.2%	1.12	\$38,176	Below
Back Office	192,030	13.4%	1.10	\$36,290	Below
Customer Service	353,260	24.7%	1.08	\$27,172	Below
Logistics - Operations	212,490	14.9%	1.01	\$39,576	Below
Design	21,190	1.5%	0.98	\$41,674	Below
Artistry	25,960	1.8%	0.96	\$34,276	Below
Environmental	6,870	0.5%	0.96	\$66,209	Above
Governance	8,170	0.6%	0.94	\$44,519	Above
Security	31,750	2.2%	0.85	\$39,461	Below
Medical	122,340	8.6%	0.78	\$45,206	Above
Education	62,160	4.4%	0.76	\$40,910	Below
Industrial Production	82,990	5.8%	0.66	\$36,587	Below
Bio-based	7,840	0.5%	0.61	\$51,142	Above
Personal Service	3,400	0.2%	0.55	\$39,876	Below

\*Includes the metros of Denver-Aurora, Boulder, Fort Collins, and Greeley

\*\*Average salary for Denver WIRED region is \$41,856

As shown in the bubble chart below, several workforce competencies are expected to experience high growth in the Metro Denver WIRED Region over the next 10 years, according to the Colorado Department of Labor and Employment. Overall, the workforce is expected to grow at a 1.4% annualized rate through 2014, slightly faster than the national growth of 1.2%. **Specific competencies in software and information technologies, management, bio-based, engineering, legal, financial, and medical, are expected to grow the fastest**, while back office, operations, and industrial production are large parts of the workforce that will lag regional growth rates.

Further analysis shows how each competency will evolve over the next 10 years in terms of national competitiveness. As with the previous bubble chart, green bubbles indicate the LQ (local concentration) will grow over time, while red bubbles indicate declining competencies relative to the US. By showing how LQs change over time, a local growth rate in total jobs can be contrasted with the national growth. **While financial, medical and legal competencies are expected to grow within the Metro Denver WIRED Region (right half of the chart), their growth rates will lag the national growth in these competencies (red bubbles), and therefore, are expected to lose competitiveness relative to nation** (i.e. their location quotients will shrink). Primarily this trend points to a loss of local competitiveness versus other faster growing regions in the US, but is also a reflection of improving competencies in previously lagging areas of logistics/operations and industrial production, which bodes well for lower wage workers.



## What competencies are most important to the Metro Denver WIRED region’s industries?

**Now, let’s examine which competencies are most important to the Metro Denver WIRED Region’s target industries.** NES has examined the occupational requirements by industry within the 21 workforce competency categories (aggregations of multiple occupations, as shown in Appendix). Each worker competency (e.g. “Engineering”) has varying levels of importance to each industry, industry cluster, or major industry grouping. For the purpose of this report, the workforce competencies demanded by industry clusters as defined by NES are examined. The industry-to-competency relationship at the national level is analyzed first to determine a baseline for comparison.

Out of the thirty industry clusters tracked by NES, a select set of eight industry clusters are provided which correlate to the regional economy: Aerospace, Medical, Electronics, Energy, Resource Extraction, Financial Services, IT, and Research.

NES defines worker competencies as being a “requirement” if they are found within an industry cluster at 120% of overall levels seen in the rest of the national economy. In the table, competencies near 1.0 (parity) show which worker competencies are important, but less critical than others. Non-required competencies have a concentration quotient of less than 0.8, and their data is not shown in the table to improve readability. Using concentration quotients of competencies within an entire US industry (calculated in the same way as location quotients for industry) shows the varying levels of importance for each competency. Observe the results of this analysis:

**U.S. Industry-Competency Requirements Matrix**

Worker Competencies	Aerospace	Medical	Electronics	Energy	Finance	IT	Research	Resource Extraction
1 Management	1.55		1.31	1.71	1.47	2.61	5.78	0.96
2 Software & IT	3.17		6.73	1.59	1.23	15.80	4.15	
3 Bio-based				5.11			7.12	22.08
4 Medical		5.93						
5 Engineering	17.69		3.68	5.18		0.83	4.77	
6 Logistics - Operations	0.91		1.17	1.39			0.90	1.95
7 Industrial Production	4.55		2.08	2.40				2.23
8 Sales & Marketing			1.88		4.80	2.06	2.88	
9 Financial Strategies	1.10		1.10	1.31	6.33	1.31	2.28	
10 Artistry						1.18		
11 Security								
12 Design								0.92
13 Environmental				22.52			7.92	18.85
14 Legal								
15 Governance								
16 Education								
17 Content					0.91	1.15	2.51	
18 Customer Service								
19 Personal Service		0.91						
20 Back Office		0.88	0.87	0.89	3.99	1.18	1.48	
21 Trade skills				1.40				2.38
# of required competencies:	5	1	7	9	5	7	9	5

Note: NES defines competencies as being required if they are found within an industry cluster at 120% of overall levels seen throughout the economy.

Source: New Economy Strategies LLC; base data from US BLS

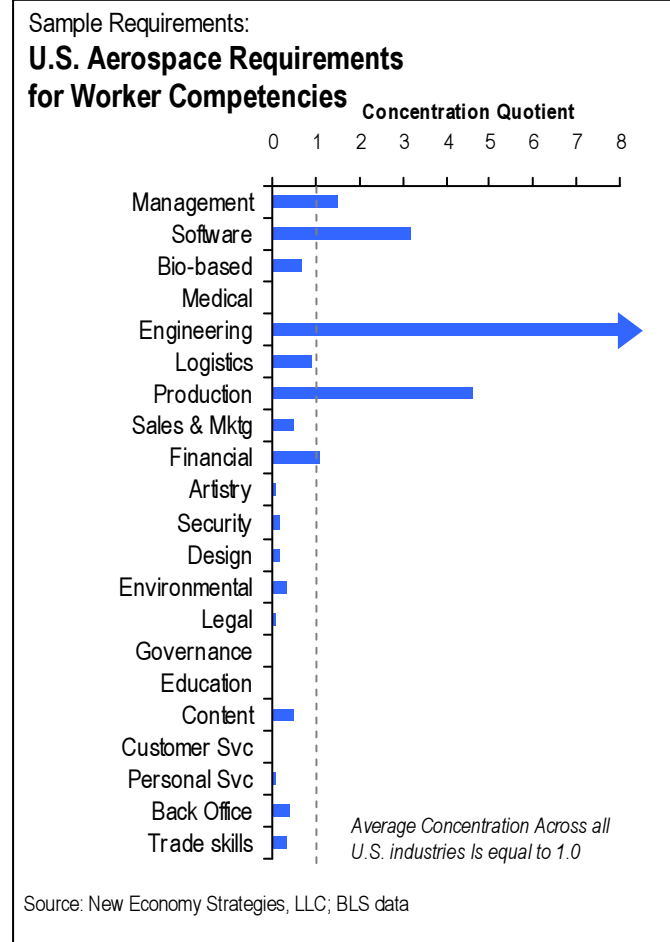
For the industry clusters of the Metro Denver WIRED Region, nearly all require high-end workers in the areas of **Software & IT** and **Engineering**. High-end professionals are also heavily required in the non-technical areas of **Management**, **Financial Strategies**, and **Sales & Marketing**.

Lower-end positions in **Back Office** are important to service industries such as IT, Financial Services, and Research, but less so to the manufacturing industries, which have greater need for mid-level positions in **Logistics & Operations** and **Industrial Production** workers.

Among the eight selected industry clusters, only IT requires **Artistic Talent**, and **Content** professionals are important to both IT and Research industries.

The Research industry cluster requires a wide breadth of talent, from Management and IT to Back Office workers. The Energy industry also requires a large number of worker competencies, from high- and mid-level strategists and salespeople to technical talent.

The chart to the right shows which worker competencies are most important to the Aerospace cluster (NAICS 3364 - Aerospace Product and Parts Manufacturing; 9271 - Space Research and Technology).



The follow table shows the top 5 requirements of each industry across the entire U.S.:

**Top 5 Worker Competency Requirements across the entire U.S.**

Top 5	Aerospace	Biomedical	Energy	Resource Extraction
1	Engineering	Medical	Environmental	Bio-based
2	Industrial Production	Personal Service	Engineering	Environmental
3	Software & IT	Back Office	Bio-based	Trade skills
4	Management	Education	Industrial Production	Industrial Production
5	Financial Strategies	Management	Management	Logistics - Operations
Top 5	Finance	Information Technology	Electronics	Research
1	Financial Strategies	Software & IT	Software & IT	Environmental
2	Sales & Marketing	Management	Engineering	Bio-based
3	Back Office	Sales & Marketing	Industrial Production	Management
4	Management	Financial Strategies	Sales & Marketing	Engineering
5	Software & IT	Artistry	Management	Software & IT

Source: New Economy Strategies LLC

## How well does the Metro Denver WIRED Region serve the competency needs of its target industries?

NES can contrast the worker competency strengths of the entire region to the specific needs of industry as identified above. For each competency-industry requirement, the region receives one to three checkmarks to indicate how well the region serves the industry:

### Metro Denver WIRED Region Competencies that Serve Industry Needs

Worker Competencies	Denver WIRED Competency	Aerospace	Medical	Electronics	Energy	Finance	IT	Research	Resource Extraction
	CQ								
1 Management	1.17	✓✓		✓✓	✓✓	✓✓	✓✓	✓✓	
2 Software & IT	1.65	✓✓✓		✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	
3 Bio-based	0.61				⊖			⊖	⊖
4 Medical	0.78		⊖						
5 Engineering	1.29	✓✓✓		✓✓✓	✓✓✓			✓✓✓	
6 Logistics - Operations	1.01			✓	✓				✓
7 Industrial Production	0.66	⊖		⊖	⊖				⊖
8 Sales & Marketing	1.18			✓✓		✓✓	✓✓	✓✓	
9 Financial Strategies	1.38	✓✓✓		✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	
10 Artistry	0.96						⊖		
11 Security	0.85								
12 Design	0.98								
13 Environmental	0.96				⊖			⊖	⊖
14 Legal	1.14								
15 Governance	0.94								
16 Education	0.76								
17 Content	1.24						✓✓✓	✓✓✓	
18 Customer Service	1.08								
19 Personal Service	0.55								
20 Back Office	1.10					✓	✓	✓	
21 Trade skills	1.12				✓✓				✓✓

<table border="1"> <tr><td>✓✓✓</td></tr> <tr><td>✓✓</td></tr> <tr><td>✓</td></tr> <tr><td>⊖</td></tr> </table>	✓✓✓	✓✓	✓	⊖	<p>CQ is</p> <p>&gt; 1.2      Indicates</p> <p>1.1 to 1.2      Very strong support by Denver WIRED in required competency for the cluster</p> <p>1.0 to 1.1      Strong support</p> <p>&lt; 1.0      Support</p> <p>                    Lack of support</p>
✓✓✓					
✓✓					
✓					
⊖					

Source: New Economy Strategies LLC; BLS data

Most of the target industries for the Denver WIRED Region take advantage of the competencies available locally. Possible gaps become apparent in the analysis:

- 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 sea port 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.

- A recent survey\* of aerospace employers in the region showed that skills such as systems engineering and data security are in high demand. High demand positions include Engineering and craft/trade positions and often employers find applicants from other companies within the aerospace industry and sometimes from other industries such as IT/Software.
- The Medical industry in the region shows medical personnel in the region are difficult to find.
- The Electronics industry is supported by several regional competencies in management, software, and engineering. The lack of a large manufacturing base in the region has resulted from a concerted effort to be a design capital of the industry (particularly in Boulder) and the continued loss of manufacturing to overseas locations.
- The Energy industry is supported by most of the competency areas it requires. However, the Resource Extraction industry may be hindered by a lack of production, environmental, and bio-based workers. The Colorado School of Mines, CU, and CSU have large, strong, diverse and notable engineering programs that address these needed competencies, such as bioremediation, environmental aspects of civil engineering, and every form of energy extraction. Awareness and even expansion of these key programs must be addressed in support of the region's competency requirements.
- A recent survey of energy companies in the region showcases that the Energy industry is in need of employees with quality fundamental skills in the areas of math, science, business, and technology. The most in-demand Energy occupations fall into three major categories: scientists (engineers and physicists), technical workers (technicians and maintenance), and business operations (managers and sales).
- According to the survey results, higher-level positions within Energy businesses require more specialized skill sets. The specialized skills expressed by respondents as most lacking in the region include: Photovoltaic research and development, High volume assembly and manufacturing, Process technology and instrumentation, and Project management.
- Almost half of all surveyed companies feel that the WIRED Region's workforce is weak or very weak in experience and thus over 55% of Energy companies are forced to look outside the WIRED Region for their employees.
- The region's competencies point to a strong level of support for the Financial Services industry.
- Regional competencies match well with the needs of the IT industry, but industry surveys point to a continuing hiring need for a range of workers, from technology workers to support workers and managers.

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\* The Metro Denver WIRED Region recently conducted a workforce survey of businesses within the region's targeted industry clusters. The feedback has assisted in identifying gaps in the current workforce pipeline and is informing the region on the number of available, skilled workers in its growth industries.

- The most important skills to IT/Software businesses include programming and hardware, sales and marketing, and communications and leadership.
- The Research industry (NAICS 5416: Management, Scientific, and Technical Consulting Services) includes a broad array of research non-profits, labs, and private companies. Within the Metro Denver WIRED region, the lack of 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, but does not include medical-related fields.
- A recent survey of biosciences employers validated that the industry is experiencing a growing demand for workers with specific certifications and high ethical and security standards. Four major occupational categories most in demand by biosciences companies are high-level scientists, engineers, technicians/associates, and business and operational staff.
- Moderate to low competencies in back office would likely be validated by a variety of industries that struggle to find entry-level workers in Denver. Above average costs, but below average wages in this competency area may keep worker availability low. Financial services, IT, and research institutions may be most troubled by a lack of workers, but clearly all industries have some level of need.

Through this analysis, NES has identified several workforce competencies should be fostered in the region and marketed to future employers. A further drill-down to the competencies within each industry found in Metro Denver WIRED would provide even greater detail to the current strengths of the region. While additional research and input from companies would be required to validate each “industry-competency strength”, NES has identified the following as a starting point for further discussion:

**NES’ Top Industry-Competency Strengths found in the Metro Denver WIRED Region**

Energy Engineering & Software	Aerospace Engineering & Software	Software Information Technology
Electronics Design	Financial Strategies	Back Office Support for Finance & IT

While not all underperforming competencies should be developed locally, some gaps should be examined more closely through industry interviews and labor studies:

- Lack of production workers for Resource Extraction industries
- Availability of medical workers for the Medical industry
- Availability of bio-based scientists for the Energy and Resources industries
- Availability of back office support workers for all industries

Once competencies are determined and agreed upon by local leadership, a variety of strategic planning efforts can be modified with a competency-driven approach. Our understanding of competencies allows us to:

- Refine existing target lists to companies that require the existing competencies in the region
- Market the region based on its unique competencies
- Expand university programs around competencies that will be needed in the future
- Assist local companies in aligning their own competencies with those of the region
- Empower new and emerging industries to tap the competencies that exist in the region

Each of these actions will require significant discourse within the region and its WIRED participants. In addition, a complete competency analysis of the area's university research program, patent trends, support institutions, and infrastructure will help to further refine and prioritize this list of competencies.

## Finally, what new industry clusters could be supported by competencies found in the region?

A final valuable step in the workforce competency analysis is to determine emerging industries clusters that could be developed by cross-connecting competencies in one cluster to another.

Moving semiconductor design programmers to the pharmaceutical industry is one example of utilizing an existing competency for a new industry. The Metro Denver WIRED Region could be well-positioned to apply its competencies to the following industry clusters if it chooses to pursue them: **automotive, back office, industrial machinery, legal services, metalworking and non-profits.**

**Potential NEW Targets based on Matching Competencies in Denver WIRED**

Worker Competencies	Automotive	Back Office	Content & Design	Industrial Machinery	Legal	Metal working	Non-Profits
1 Management			Yes	Yes		Yes	Yes
2 Software & IT				Yes			
3 Bio-based							
4 Medical							no
5 Engineering	Yes			Yes		Yes	
6 Logistics - Operations	Yes	Yes	Yes	Yes			Yes
7 Industrial Production	no	no		no		no	
8 Sales & Marketing		Yes	Yes	Yes			Yes
9 Financial Strategies					Yes		Yes
10 Artistry			no				no
11 Security							no
12 Design			no				
13 Environmental							
14 Legal					Yes		
15 Governance							
16 Education							no
17 Content			Yes				Yes
18 Customer Service		Yes					
19 Personal Service				no			
20 Back Office		Yes	Yes		Yes		Yes
21 Trade skills							
Required Competencies	3	5	7	7	3	3	10
Matched	2	4	5	5	3	2	6
% Matched	67%	80%	71%	71%	100%	67%	60%

Source: New Economy Strategies LLC; BLS data

## **SECTION FOUR:**

### **APPENDIX**

I: Hubs and Nodes and the  
Transformation to Clusters of  
Knowledge & Competency

II: Sample Occupational Requirements  
of the U.S. Industry

III: Workforce Competency Definitions

IV: Industry Cluster Definitions

## APPENDIX I: Hubs and Nodes and the Transformation to Clusters of Knowledge & Competency

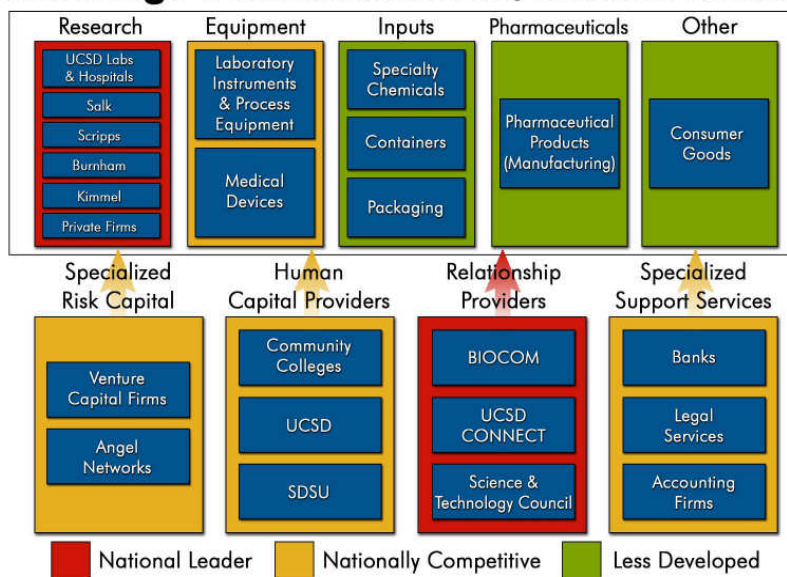
### The End of Traditional Clusters of Industry and the Transformation to Regional Hubs and Nodes

Several factors now challenge the traditional perspective and application of ‘clusters’ of industry or sectors to local and regional economies.



The notion that all the assets, value chains, and even the skills must be contained within a proximate location to each other has been traditionally viewed as critical to the success of a specific industry sector. Harvard’s Michael Porter described these industry agglomerations as ‘clusters’, and regional economies and their policies have been viewed in through this lens for decades. Clusters have been described as interconnected subeconomies that look like integrated production-based supply chains, whereby materials suppliers and component vendors provide the inputs to a large final assembly plant. Porter underscored his point with the example of Dalton, Georgia as the carpet production capital of the world. We also see that the automotive sector traditionally operated as a cluster economy (centered in Detroit). New industries such as biotechnology appear to operate as clusters (see graphic below). Cluster theory has evolved the definition of “supply chain” to include the “soft” suppliers of workers, risk capital, social networking, and support services that help companies achieve world-class practices.

### San Diego Pharmaceuticals/Biotech Cluster



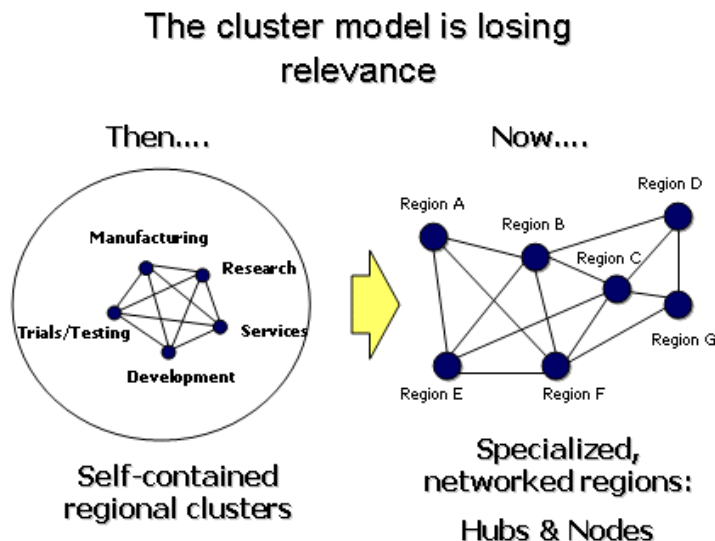
Source: Regions of Innovation Project, US Council on Competitiveness

New policy responses have emerged such as creative community strategies for places like Philadelphia, where the blossoming of young professionals helped to drive a need for a clearer set of opportunities and relationships to build a brand around regional film, music, arts, and graphics. The rebound of the Inner City of Philadelphia is due primarily to a network of interests tied to the universities, museums, design houses, film studios, and urban music scene that had created unique events – from pub crawls to monthly tours of offices where new ideas were being created every day. Older, more traditional professionals began to realize that something was changing in downtown – the number of restaurants, bookstores, and retail networks had begun to spark an increase in employment, home-based businesses, and simply the increase in the number of FedEx and UPS deliveries. There was, however, no policies in place to support or even minimize the barriers to entry for the creative community – and thus a network of networks was formed to link interests across the sectors and communities of practices – as well as to reach out to the suburbs where even more individuals and businesses in the creative sector existed. Therefore, soon emerged a set of city and county policies that sought to preserve the talent, employment, tax base, and incentives – but now in a wholly-different sector that had not existed five years before. And most importantly, the creative community meets quarterly with traditional and legacy industries to spark innovation practices and new product development.

New Economy Strategies, LLC continues to research and observe the evolution of industry clusters across the U.S. and world. We have come to the conclusion that **traditional cluster theory is coming to an end and a new theory of economic development must emerge.** In our view, the global economic landscape has changed in such a way that **we must challenge the fundamental belief of clusters of industry and the policies that make up cluster-based economic development.**

Successful companies and industries are now defined by their distributed, networked business models in which geographic location has been more and more removed as a functional requirement. For instance, the impact of outsourcing as a permanent business model indicates that larger, fully integrated corporate settings are now divested operationally and geographically. A large pharmaceutical or defense company appears more like a network of smaller enterprises, divisions, and suppliers. Sourcing strategies by companies and their industries is no longer about finding the lowest cost input that can be quickly plugged in a production model. Rather, global sourcing is viewed by CEOs as a critical piece of their entire corporate strategy, and flexibility has become the top benefit of a distributed business model, not cost reduction or resource acquisition.

We offer the following concept of “**Hubs and Nodes**” as a new view of economic development and a starting point for a new theory on regional industry formation.



As it becomes clear that research, development and commercialization can be spread across thousands of miles, the **Hubs and Nodes** model is becoming the new de facto standard for industries and companies. With activities of many industries already outsourced to various locations in the US and abroad, it is easy to see the extent to which this paradigm has already changed. As long as a particular location has sufficient critical mass to drive development – a Hub – or can significantly support development with complementary processes – a Node – it can easily participate in this new industry paradigm, no matter its location. Few regions in the future will ‘own’ all the assets and attributes of one industry sector.

Consider how the electronics industry relies on sourcing from countries all over the world, or how the financial services sector relies on software development done in India. Only heavy industries such as automotive and aerospace retain their tight locally-driven supply chain due to a need for just-in-time delivery, but even this model is under increasing strain.

The proposition for a hub and nodes concept is based on the realities of a changing corporate, business model as noted previously. Simply put, U.S. firms and sectors are becoming more and more like the independent film industry. The so-called studio handles the financing, production, and overall project management while all the other elements – competencies – are outsourced into a network that actually creates the final product. One firm does the music, another does the script and writing, while another still does the graphics and computational designs for the ‘whiz-bang’ backdrops. Therefore, the film industry in the U.S. is no longer a fully-integrated enterprise but rather a network of loosely connected individuals and competencies tied by a common purpose of a project and a deliverable. More and more these networks are global – and work 24x7 on contributing their piece of the value chain.

Many regions in the U.S. have already accumulated the critical mass to compete globally in several technology-based industry clusters. These clusters are highly productive, have strong concentrations of knowledge workers, and are further complemented by strong regional assets

including government labs, universities, and infrastructure. The imperative to remain competitive in the industry clusters requires the region to seek out strategies that preserve current advantages while identifying and creating new opportunities. Simply put, innovation now demands significant review of the traditional clusters model and the adaptation and adoption of a new approach to the most critical elements of concentration: human capital, knowledge, and unique competencies.

Observe how a hubs and nodes model is reinvigorating America's rural communities:

Another type of growth node in the Heartland is the "reemerging hub." These are usually small and mid-sized cities that grew up during the period of agricultural expansion in the late 19th and early 20th centuries, and then began to decline or plateau economically in midcentury. Today, such cities—among them, Fargo, North Dakota, Sioux Falls, South Dakota, Des Moines, Iowa, and Boise, Idaho—are making what many might find surprising headway in the information age. They are exploiting their advantages, which include a lower cost of living, good public schools and universities, and quality-of-life attractions for middle class families, to lure high-end business and professional service firms, information service companies, and diversified, innovative small manufacturers. - *Rebuilding America's Productive Economy, A Heartland Development Strategy*

## Moving from Clusters to Knowledge & Competencies

Reason stands that if the business model is now permanently networked, that operations are being created about hubs and nodes, and that distributed placement of the entrepreneurial firms of the future is the de facto scenario, then how do we measure the success of economic centers, and what factors are the most important in driving local prosperity? The challenge for regions is to inventory local assets and networks, and determine combinations of local assets that are best suited to global collaboration. Given the shift to business models that are permanently networked, NES believes that concentrations of expertise, talent, skills, knowledge, and competencies are now more valuable to measure and support across the region rather than focusing on cluster development and boosting local supplier gaps.

What is needed today is a shift in regional thinking from simply measuring size and concentration of local production along a value chain to looking at capabilities and capacity distributed across multiple regions and countries in a way that maximizes responsiveness to markets and reduces cost. Since the creation of intellectual property might occur in one location; production, manufacturing, sales and distribution in others; while corporate headquarters reside in another region; it is becoming more difficult to measure the regional economic impact using traditional means. A movement toward “Clusters of Knowledge & Competency” requires that local analysis and models adapt toward global networks of innovation, production, and know-how:

### Traditional vs. Knowledge-Driven Clusters

Traditional Industry Cluster Model	Clusters of Knowledge and Competency Model
All elements of the value chain reside locally	Globally distributed, networked supplier chains
Local concentration or critical mass of all or most sub-elements	Concentration and critical mass of specific and unique elements linked to other locations with complementary concentrations
Concentration of assets in skills, knowledge and the locally integrated pathway from discovery to market in a handful of enterprises	Networked, outsourced or even off-shored business model linking independent firms with large procurement entities
Formation of cluster organizations or associations that seek to promote the cluster	Formation of networks of networks around product and service creation that are often at will and dynamic
Connectivity among and around end-users or ‘exporters’ that seek to build the final products	Recognition that innovation is a social activity among a number of minds, ideas, and institutions that learn to work collaboratively about a solution or tactic
Financial, business services located proximate to the cluster activities	Recognition that open-source innovation is emerging as the means of intellectual property creation, management, exploitation whereby know-how is distributed regionally and globally
Know-how and knowledge is often driven by top-down, growth and mature enterprises	Recognition in the meritocracy that know-how, know-whom, and know-what is found among a broad set of stakeholders and interests

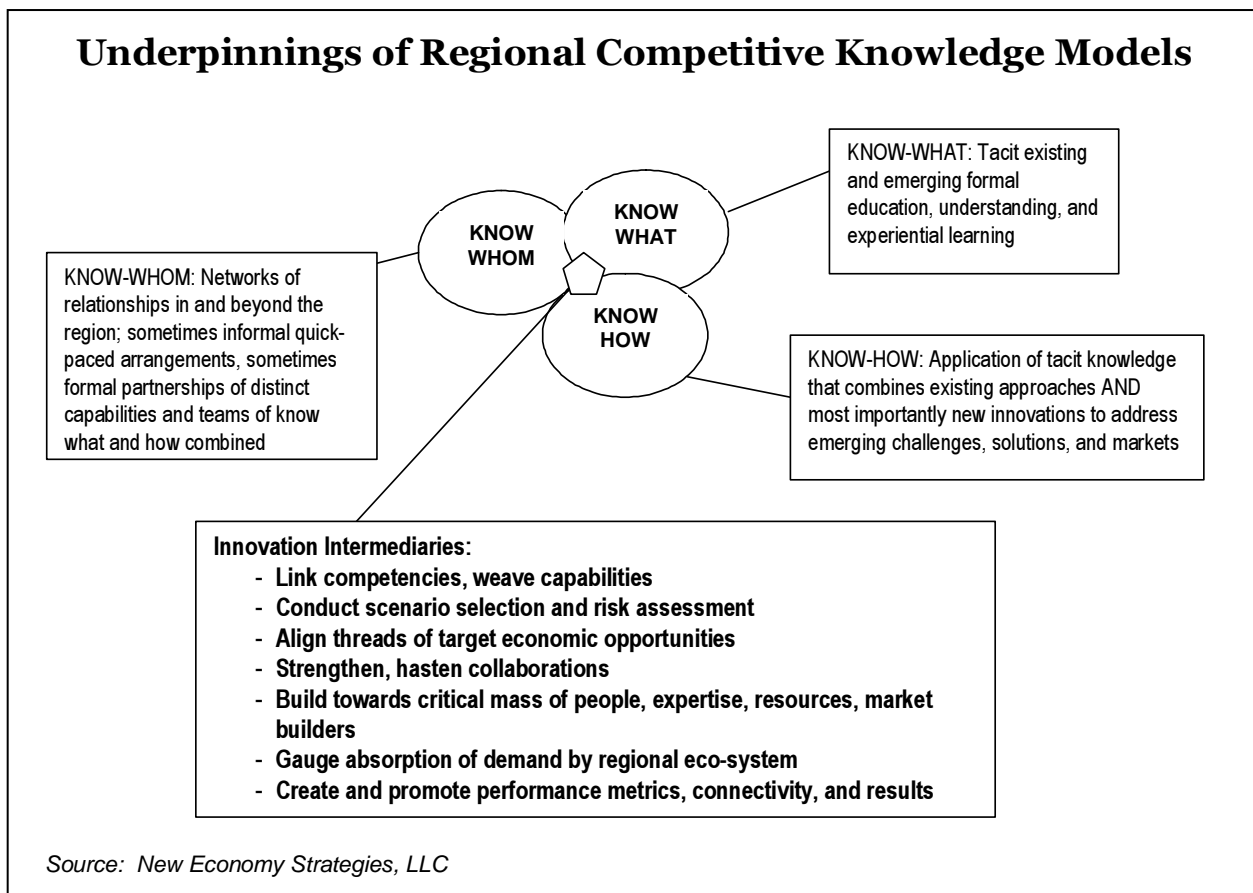
Clusters of Knowledge & Competency reflect a new paradigm around **Know-How, Know-What, and Know-Whom**:

**Know-How:** Application of tacit knowledge that combines existing approaches AND most importantly new innovations to address emerging challenges, solutions, and markets

**Know-What:** Tacit existing and emerging formal education, understanding, and experiential learning

**Know-Whom:** Networks of relationships in and beyond the region; sometimes informal quick-paced arrangements, sometimes formal partnerships of distinct capabilities and teams of know what and how combined

Regional Intermediaries become the necessary link between the How-What-Whom in a region by creating Teams of Interdisciplinary science, research, discovery, applied technology, business and strategy models, trends and forecasting, and production-manufacturing-delivery. However, these teams of HOW-WHAT- WHOM are comprised of different competencies and skill levels, and more importantly are now distributed in and beyond the region.



Creating **Collaborative Knowledge Teams** requires new forms, measures, and relationships:

- Design around the process, not the performance – getting the job done versus how fast, how cheap
- Measure and reward the team not individuals
- Analyze and apply relevant data and collect based on the process needs not what would be cool to know
- Determine operational trade-offs, prioritize goals as immediate-near-term-long-term
- Delegate responsibility to the team for implementation and integration among other teams, organizations, and institutions – build networks!

How-What-Whom can then be linked back to a region's target industry sectors – here are some examples:

### **Logistics**

- industrial design, advanced manufacturing, information systems, electronic sensors and controls, engineering, and delivery/ transportation

### **Biomedical**

- biological sciences, computational and mechanical engineering, information systems, health and patient statistics and demographics

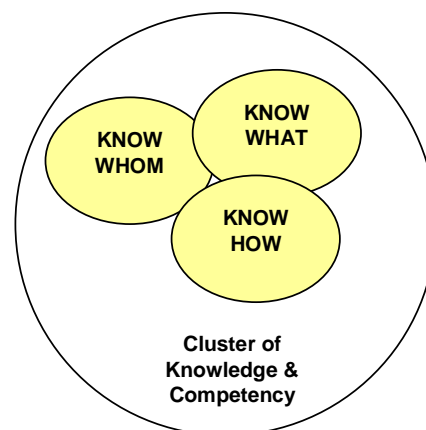
### **Renewable Energy:**

- agribiotech, materials science, fermentation and chemical processing, mechanical engineering, farming and transport related services

To be successful, Collaborative Knowledge Teams must integrate across lines of experience and trends in technical applications around specific market, economic, and/or societal challenges.

Clusters of Knowledge & Competency are formed when the Know-How, Know-What, and Know-Whom are linked throughout a region:

## **Clusters of Knowledge & Competency: Linking What-How-Whom**



When a region completes its asset mapping and inventory leading to a new strategy around Knowledge and Competencies – the hardest task is holding it all together. Our conclusion is that the economic and workforce communities require newer mechanisms – Innovation Intermediaries – that sustain the asset mapping by linking and leveraging the networks of relationships and talent to achieve more effective and efficient use of resources, time, and leadership. Just to have mapped the How-What-Whom assets and knowledge will only produce a new “yellow pages” and document the capabilities of a the region. The most important expression of implementation will be the exploitation of those networks and competencies by a neutral third-party function or entity that all parties are comfortable with and agree upon its role and responsibilities. No one institution or organization can manage this alone – and thus an **Innovation Intermediary** must be created in most instances to provide the platform on which to catalyze and guide – not direct nor force – the Cluster of Knowledge and Competency. There are several examples of these Intermediaries in the US and around the world – innovation zones, innovation centers, and innovation networks. What a region chooses as its intermediary will and must reflect the culture and characteristics of political and civic will, leadership, and resources based on trust and a common scenario.

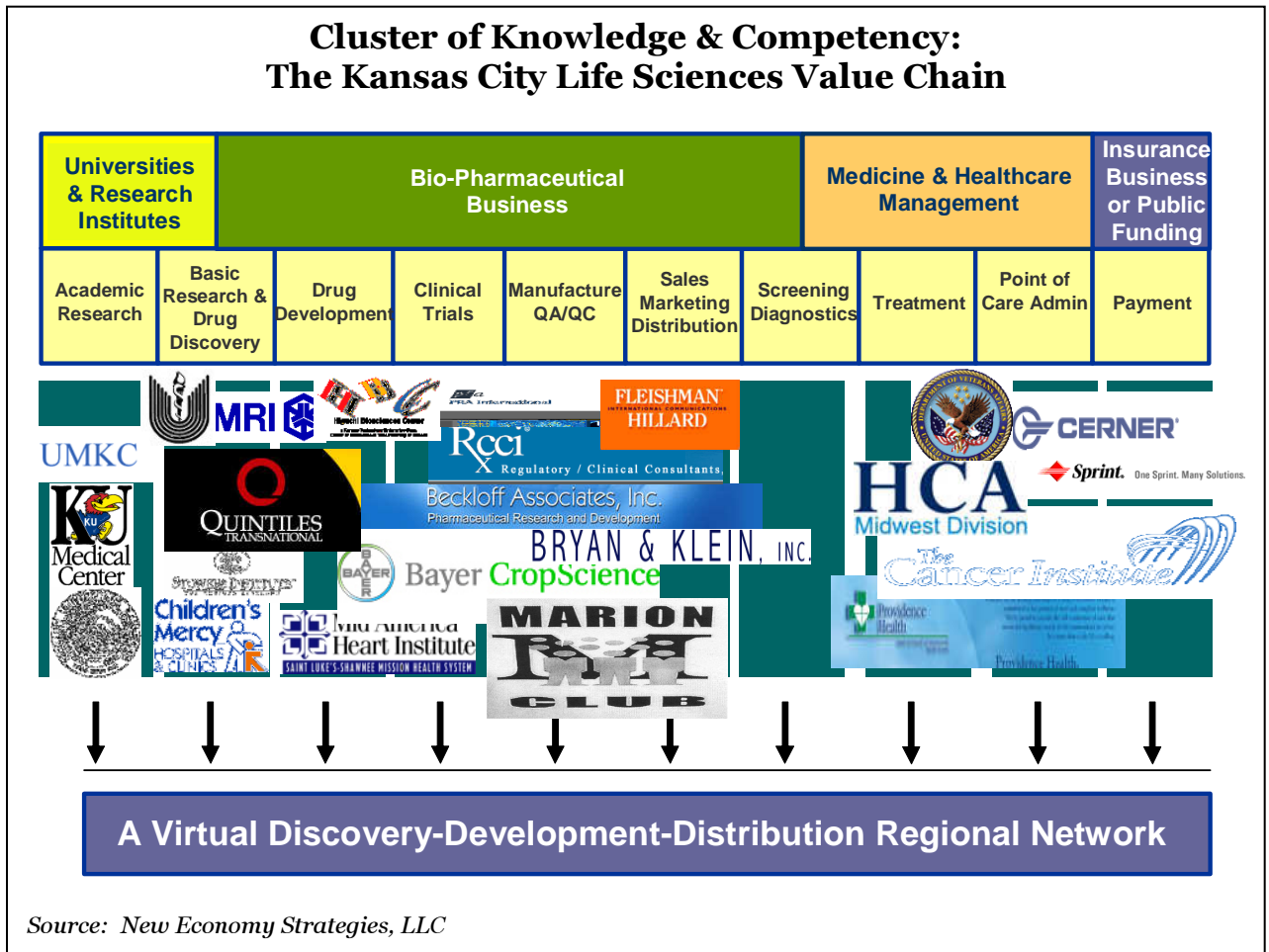
What are the benefits of adopting a model based on **Clusters of Knowledge & Competency**?

A model based on Clusters of Knowledge & Competency recognizes that a community may have a significant strength within the value chain of a cluster that should be leveraged for future growth and development. In most cases, communities should focus more on their strengths (than fill their cluster gaps), and begin network their competencies with other parts of the country and world who need them. By recognizing the competencies of a region within a cluster, we can better define the region’s path going forward.

A model based on Clusters of Knowledge & Competency also recognizes that **competencies can cross into multiple unique industry clusters**. A competency in optics can support clusters as diverse as aerospace (laser guidance), medicine (PET scanning), electronics (document imaging), and telecommunications (fiber optic routers). Why does Optics appear more like a competency than an industry? Optics is a competency because its production workers, university research, and suppliers can participate in multiple clusters. Optics is a competency because it is the portion of the cluster’s value chain that is driving innovation and the success of companies in its field. This type of competency is found in Rochester, NY, the hometown of Kodak (imaging) and now home to a diverse set of optics companies serving multiple clusters.

Finally, a model based on Clusters of Knowledge & Competency allows us to **identify new opportunities in new clusters that may not be found in a region** but have strong potential due the presence of a unique competency. By definition, competencies can serve multiple clusters and most do. By analyzing a region’s competencies, we discover not only what the competencies are, but which clusters the competencies are currently serving. Since we know the competencies requirements of national clusters, we can now quickly identify which additional clusters could be served by a region’s existing competencies. Cross-cutting between clusters and developing new clusters from existing clusters should become the next evolutionary step in cluster-based economic development.

Observe how a competency-driven approach in Kansas City has fed the growth of a vibrant life sciences cluster along the full value chain:

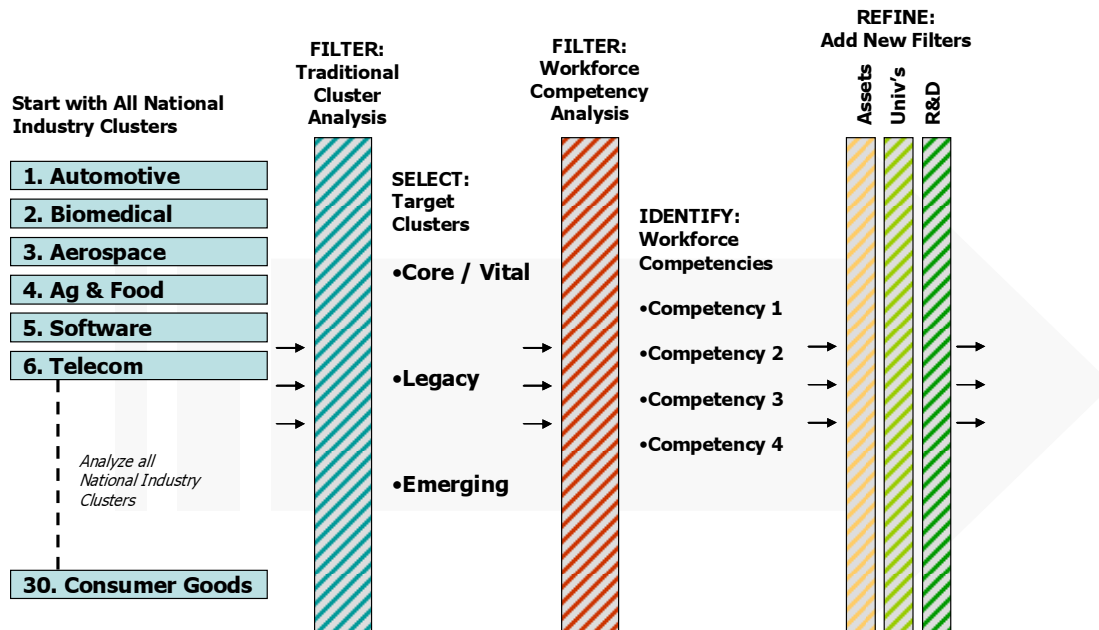


Feedback from industry executives, workforce development officials, and economic developers further validates the need for a new model that is multidisciplinary, cross-industry, and knowledge-based. Traditional attempts to view economies *in terms of their industries* have only created silos across leadership and programs. Students and workers likewise understand that their career is not levered to a single industry, but that industries ebb and flow, they will need to continue to apply their competencies to new markets, new industries, and new organizational systems.

# Clusters of Knowledge & Competency: Analytical Framework

As developed by New Economy Strategies, the Clusters of Knowledge & Competency analytical framework involves a step-by-step process that refines a list of competitive advantages for a region and ultimately arrives at a region’s best targets of opportunity as a Cluster of Knowledge & Competency, beginning with a traditional **Industry Cluster Analysis** of a region’s existing cluster strengths to arrive at a list of core, legacy, and emerging targets.

## Clusters of Knowledge & Competency ANALYTICAL SELECTION PROCESS



Source: New Economy Strategies, LLC

A **Workforce Competency Analysis** identifies workforce strengths and ultimately arrives at regional competencies in workforce, such as aerospace engineering, technology design, or finance. These competencies are much more than the traditional workforce system’s competency ladder based on an individual’s basic skills. Rather, these competencies are specifically define around a region’s precise Know-What, Know-How, and Know-Whom !

The competency analysis is then refined further by including additional datasets in the analysis: **patents, R&D, universities, venture capital**, etc. For each, new or deeper competencies are identified, i.e. research competencies, entrepreneur competencies, etc. The results rely on both data analysis and qualitative input from local leadership and stakeholders.

Understanding Clusters of Knowledge & Competency enable leadership to position programs and initiatives as well as resource allocations and performance measures to form the region’s truly unique competitive advantages.

## APPENDIX II: Sample Occupational Requirements of the U.S. Industry

Below is an example of the occupational demand profile for an aerospace company:

### Workforce Requirements - U.S. Nationwide Aerospace Industry Cluster\*

Code	Occupation Description	Industry Concentration	Total US Jobs	Average Salary
<i>High Job Demand (Large Employment in Industry)</i>				
17-2011	<b>Aerospace engineers</b>	146.6	40,860	\$80,920
51-2011	<b>Aircraft structure, surfaces, rigging, and systems assem</b>	261.5	20,510	\$42,360
49-3011	<b>Aircraft mechanics and service technicians</b>	45.7	18,070	\$45,400
51-4041	<b>Machinists</b>	12.9	16,290	\$39,220
51-9061	Inspectors, testers, sorters, samplers, and weighers	8.6	14,930	\$42,030
17-2141	<b>Mechanical engineers</b>	17.5	13,270	\$75,090
17-2112	<b>Industrial engineers</b>	19.8	13,020	\$68,080
11-9041	Engineering managers	15.5	10,000	\$109,030
15-1031	Computer software engineers, applications	6.3	9,890	\$81,910
13-1111	Management analysts	5.8	8,750	\$68,790
<i>Specialized Demand (High Concentration within Industry)</i>				
51-2011	<b>Aircraft structure, surfaces, rigging, and systems assem</b>	261.5	20,510	\$42,360
17-3021	Aerospace engineering and operations technicians	154.4	5,280	\$53,490
17-2011	<b>Aerospace engineers</b>	146.6	40,860	\$80,920
49-2091	Avionics technicians	61.1	4,720	\$48,290
49-3011	<b>Aircraft mechanics and service technicians</b>	45.7	18,070	\$45,400
17-3026	Industrial engineering technicians	25.2	6,350	\$60,810
17-2131	Materials engineers	25.0	1,800	\$78,150
17-2112	<b>Industrial engineers</b>	19.8	13,020	\$68,080
13-1081	Logisticians	17.8	3,190	\$62,470
17-2141	<b>Mechanical engineers</b>	17.5	13,270	\$75,090
17-3029	Engineering technicians, except drafters, all other	16.2	4,360	\$54,560
53-2022	Airfield operations specialists	16.1	250	\$62,590
11-9041	Engineering managers	15.5	10,000	\$109,030
51-9022	Grinding and polishing workers, hand	15.1	2,330	\$27,550
51-4199	Metal workers and plastic workers, all other	14.9	2,550	\$42,320
17-2199	Engineers, all other	14.9	7,820	\$80,500
49-2093	Electrical and electronics installers and repairers, transporta	14.9	1,050	\$50,840
51-4035	Milling and planing machine setters, operators, and tenders,	14.8	1,480	\$39,830
51-2031	Engine and other machine assemblers	14.7	2,490	\$46,070
51-4041	<b>Machinists</b>	12.9	16,290	\$39,220

\*3364 - Aerospace Product and Parts Manufacturing

\*9271 - Space Research and Technology

Occupations are bolded that are in both categories -- high LQ and high demand

Source: New Economy Strategies; BLS 2005

Below is an example of the occupational demand profile for a pharmaceutical company:

**Workforce Requirements - U.S. Nationwide**  
**3254 - Pharmaceutical and Medicine Manufacturing**

Code	Occupation Description	Industry Concentration	Total US Jobs	Average Salary	Salary for Top 10%
<i>High Job Demand (Large Employment in Industry)</i>					
51-9111	<b>Packaging and filling machine</b>	25.2	21,990	\$26,800	\$41,470
19-2031	<b>Chemists</b>	76.6	12,920	\$62,250	\$100,380
51-9011	<b>Chemical equipment operators and tenders</b>	97.1	10,820	\$35,000	\$50,770
19-1042	<b>Medical scientists, except epidemiologists</b>	63.8	10,350	\$81,240	\$123,120
51-9023	<b>Mixing and blending machine setters, operators, and</b>	31.7	9,040	\$30,770	\$44,920
19-4021	<b>Biological technicians</b>	58.5	8,640	\$38,550	\$56,960
51-9061	Inspectors, testers, sorters, samplers, and weighers	7.7	8,620	\$35,850	\$57,080
51-1011	First-line supervisors/managers of production and opera	5.0	7,420	\$56,730	\$83,170
41-4011	Sales representatives, wholesale and manufacturing, te	7.7	6,460	\$71,090	\$112,830
13-1199	Business operations specialists, all other	3.0	6,140	\$60,900	\$94,850
<i>Specialized Demand (High Concentration within Industry)</i>					
19-1021	Biochemists and biophysicists	109.3	4,260	\$81,240	\$118,900
19-1022	Microbiologists	100.9	3,390	\$61,540	\$102,000
51-9011	<b>Chemical equipment operators and tenders</b>	97.1	10,820	\$35,000	\$50,770
17-2031	Biomedical engineers	77.9	2,000	\$76,510	\$110,210
19-2031	<b>Chemists</b>	76.6	12,920	\$62,250	\$100,380
19-1042	<b>Medical scientists, except epidemiologists</b>	63.8	10,350	\$81,240	\$123,120
19-1099	Life scientists, all other	59.6	1,680	\$76,420	\$139,980
19-4021	<b>Biological technicians</b>	58.5	8,640	\$38,550	\$56,960
19-2032	Materials scientists	54.7	950	\$66,100	\$101,690
51-9012	Separating, filtering, clarifying, precipitating, and still ma	52.5	4,770	\$36,840	\$52,630
11-9121	Natural sciences managers	42.6	3,790	\$115,650	\$145,600+
19-4031	Chemical technicians	37.3	4,910	\$40,590	\$57,200
51-9023	<b>Mixing and blending machine setters, operators, and</b>	31.7	9,040	\$30,770	\$44,920
19-1029	Biological scientists, all other	29.5	1,700	\$68,390	\$106,150
51-9111	<b>Packaging and filling machine operators and tender</b>	25.2	21,990	\$26,800	\$41,470
15-2041	Statisticians	24.2	930	\$81,030	\$125,000
17-2041	Chemical engineers	22.4	1,360	\$78,230	\$115,780
17-3026	Industrial engineering technicians	18.5	2,990	\$49,970	\$75,580
51-8091	Chemical plant and system operators	17.9	2,310	\$39,150	\$59,030

Occupations are bolded that are in both categories -- high LQ and high demand

Source: New Economy Strategies; BLS 2005

## APPENDIX III: Workforce Competency Definitions

NES has organized all 733 occupations found in the U.S. into the following 21 competency groups, generally defined as follows:

- Management: primarily Chief Executive Officers, general managers, and management analysts
- Software & IT: software programmers and engineers; electronic, telecommunications, and electrical engineers, technicians, and repairers
- Bio-based: agriculture workers/technicians; chemical, materials, nuclear scientists and technicians
- Medical: health care workers only, such as nurses, doctors, home health workers, therapists, and counselors
- Engineering: civil, mechanical, aerospace, nuclear engineers
- Logistics – Operations: laborers, material movers, bookkeepers, purchasing managers, human resource managers, transportation workers
- Industrial Production: production/maintenance workers, industrial engineers, production managers
- Sales & Marketing: telemarketers, sales/marketing managers, real estate brokers
- Financial Strategies: accountants, financial managers, budget analysts, economists
- Artistry: actors, directors, performers, fine artists
- Security: police, fire, security guards, emergency management, corrections officers
- Design: graphics design, furniture/textiles workers and designers, multimedia designers, architects, landscape designers, film and camera operators
- Environmental: environmental/petroleum engineers and workers, geoscientists, hazardous materials workers, conservation specialists
- Legal: lawyers, legal clerks, judges
- Governance: postal workers, legislators
- Education: teachers (primary, secondary, post-secondary)
- Content: writers/editors, public relations, interpreters, printing technicians, museum curators
- Customer Service: retail workers, hotel workers, restaurant workers, gaming workers
- Personal Service: HVAC workers, dry cleaning, home repairers/installers
- Back Office: office workers, data entry, clerks
- Trade Skills: primarily construction workers

The following table highlights the top 10 occupations (as a percentage of total employment) in each competency group:

#	Competency Group	Occ Code	Occupation Title	Share of Cluster
1	Management	11-1021	General and operations managers	65.4%
1	Management	13-1111	Management analysts	17.3%
1	Management	11-1011	Chief executives	12.6%
2	Software & IT Engineering	15-1041	Computer support specialists	10.9%
2	Software & IT Engineering	15-1051	Computer systems analysts	10.7%
2	Software & IT Engineering	15-1031	Computer software engineers, applications	9.9%
2	Software & IT Engineering	15-1021	Computer programmers	8.5%
2	Software & IT Engineering	15-1032	Computer software engineers, systems software	7.0%
2	Software & IT Engineering	15-1071	Network and computer systems administrators	5.9%
2	Software & IT Engineering	11-3021	Computer and information systems managers	5.6%
2	Software & IT Engineering	51-2022	Electrical and electronic equipment assemblers	4.5%
2	Software & IT Engineering	49-2022	Telecommunications equipment installers and repairers, except line installers	4.3%
2	Software & IT Engineering	15-1081	Network systems and data communications analysts	4.0%
3	Bio	45-2092	Farmworkers and laborers, crop, nursery, and greenhouse	18.8%
3	Bio	19-2031	Chemists	6.3%
3	Bio	19-4021	Biological technicians	5.5%
3	Bio	19-4099	Life, physical, and social science technicians, all other	5.3%
3	Bio	19-4031	Chemical technicians	4.9%
3	Bio	25-1042	Biological science teachers, postsecondary	4.9%
3	Bio	51-8091	Chemical plant and system operators	4.8%
3	Bio	51-9011	Chemical equipment operators and tenders	4.2%
3	Bio	45-2093	Farmworkers, farm and ranch animals	4.1%
3	Bio	45-2041	Graders and sorters, agricultural products	3.7%
4	Medical	29-1111	Registered nurses	16.7%
4	Medical	31-1012	Nursing aides, orderlies, and attendants	9.8%
4	Medical	29-2061	Licensed practical and licensed vocational nurses	5.0%
4	Medical	31-1011	Home health aides	4.7%
4	Medical	39-9021	Personal and home care aides	4.0%
4	Medical	39-9011	Child care workers	3.9%
4	Medical	31-9092	Medical assistants	2.7%
4	Medical	43-6013	Medical secretaries	2.7%
4	Medical	21-1093	Social and human service assistants	2.2%
4	Medical	31-9091	Dental assistants	1.9%
5	Engineering	17-2051	Civil engineers	15.3%
5	Engineering	17-2141	Mechanical engineers	14.7%
5	Engineering	11-9041	Engineering managers	12.5%
5	Engineering	17-2199	Engineers, all other	10.2%
5	Engineering	51-8031	Water and liquid waste treatment plant and system operators	6.8%
5	Engineering	17-3022	Civil engineering technicians	6.0%
5	Engineering	17-2011	Aerospace engineers	5.4%
5	Engineering	17-3029	Engineering technicians, except drafters, all other	5.2%
5	Engineering	17-3013	Mechanical drafters	5.0%
5	Engineering	17-3027	Mechanical engineering technicians	3.1%

#	Competency Group	Occ Code	Occupation Title	Share of Cluster
6	Logistics – Operations	53-7062	Laborers and freight, stock, and material movers, hand	12.2%
6	Logistics – Operations	43-3031	Bookkeeping, accounting, and auditing clerks	9.4%
6	Logistics – Operations	43-5081	Stock clerks and order fillers	8.4%
6	Logistics – Operations	53-3032	Truck drivers, heavy and tractor-trailer	8.4%
6	Logistics – Operations	53-3033	Truck drivers, light or delivery services	4.9%
6	Logistics – Operations	13-1199	Business operations specialists, all other	4.7%
6	Logistics – Operations	53-7064	Packers and packagers, hand	4.3%
6	Logistics – Operations	43-5071	Shipping, receiving, and traffic clerks	3.9%
6	Logistics – Operations	53-7051	Industrial truck and tractor operators	3.2%
6	Logistics – Operations	43-3021	Billing and posting clerks and machine operators	2.7%
7	Industrial Production	49-9042	Maintenance and repair workers, general	11.2%
7	Industrial Production	51-2092	Team assemblers	10.7%
7	Industrial Production	51-1011	First-line supervisors/managers of production and operating workers	5.8%
7	Industrial Production	49-3023	Automotive service technicians and mechanics	5.6%
7	Industrial Production	51-9198	Helpers--production workers	4.5%
7	Industrial Production	51-9061	Inspectors, testers, sorters, samplers, and weighers	4.4%
7	Industrial Production	51-9111	Packaging and filling machine operators and tenders	3.4%
7	Industrial Production	51-4041	Machinists	3.2%
7	Industrial Production	51-4121	Welders, cutters, solderers, and brazers	3.1%
7	Industrial Production	51-9199	Production workers, all other	2.5%
8	Sales & Marketing	41-9041	Telemarketers	17.3%
8	Sales & Marketing	11-2022	Sales managers	13.7%
8	Sales & Marketing	41-3021	Insurance sales agents	12.9%
8	Sales & Marketing	43-4111	Interviewers, except eligibility and loan	8.7%
8	Sales & Marketing	19-3021	Market research analysts	8.4%
8	Sales & Marketing	41-9099	Sales and related workers, all other	7.7%
8	Sales & Marketing	11-2021	Marketing managers	7.2%
8	Sales & Marketing	41-3011	Advertising sales agents	6.6%
8	Sales & Marketing	41-9022	Real estate sales agents	6.5%
8	Sales & Marketing	41-9011	Demonstrators and product promoters	3.4%
9	Financial Strategies	13-2011	Accountants and auditors	41.4%
9	Financial Strategies	11-3031	Financial managers	18.6%
9	Financial Strategies	41-3031	Securities, commodities, and financial services sales agents	9.9%
9	Financial Strategies	13-2051	Financial analysts	7.1%
9	Financial Strategies	13-2099	Financial specialists, all other	4.8%
9	Financial Strategies	13-2052	Personal financial advisors	4.3%
9	Financial Strategies	13-2053	Insurance underwriters	3.9%
9	Financial Strategies	13-2041	Credit analysts	2.4%
9	Financial Strategies	13-2031	Budget analysts	2.1%
9	Financial Strategies	25-1022	Mathematical science teachers, postsecondary	1.8%
10	Artistry	27-2099	Entertainers and performers, sports and related workers, all other	2.7%
10	Artistry	27-2011	Actors	2.4%
10	Artistry	27-2012	Producers and directors	2.4%
10	Artistry	27-2042	Musicians and singers	2.0%
10	Artistry	27-1011	Art directors	1.4%

#	Competency Group	Occ Code	Occupation Title	Share of Cluster
10	Artistry	11-9081	Lodging managers	1.2%
10	Artistry	27-2031	Dancers	0.6%
10	Artistry	27-2032	Choreographers	0.6%
10	Artistry	27-1013	Fine artists, including painters, sculptors, and illustrators	0.5%
10	Artistry	13-1011	Agents and business managers of artists, performers, and athletes	0.4%
11	Security	33-9032	Security guards	29.2%
11	Security	33-3051	Police and sheriff's patrol officers	18.3%
11	Security	33-3012	Correctional officers and jailers	12.1%
11	Security	33-2011	Fire fighters	8.3%
11	Security	43-5032	Dispatchers, except police, fire, and ambulance	5.1%
11	Security	33-9099	Protective service workers, all other	4.2%
11	Security	33-9092	Lifeguards, ski patrol, and other recreational protective service workers	3.2%
11	Security	43-5031	Police, fire, and ambulance dispatchers	2.8%
11	Security	33-1012	First-line supervisors/managers of police and detectives	2.7%
11	Security	33-3021	Detectives and criminal investigators	2.5%
12	Design	51-6031	Sewing machine operators	11.2%
12	Design	27-1024	Graphic designers	8.6%
12	Design	51-7011	Cabinetmakers and bench carpenters	5.8%
12	Design	17-3011	Architectural and civil drafters	4.8%
12	Design	17-1011	Architects, except landscape and naval	4.6%
12	Design	51-7042	Woodworking machine setters, operators, and tenders, except sawing	4.5%
12	Design	51-6021	Pressers, textile, garment, and related materials	3.8%
12	Design	27-1026	Merchandise displayers and window trimmers	3.1%
12	Design	27-1023	Floral designers	3.1%
12	Design	17-3031	Surveying and mapping technicians	3.1%
13	Environmental	47-4051	Highway maintenance workers	20.9%
13	Environmental	19-2041	Environmental scientists and specialists, including health	10.7%
13	Environmental	17-2081	Environmental engineers	7.4%
13	Environmental	47-4041	Hazardous materials removal workers	5.7%
13	Environmental	47-5071	Roustabouts, oil and gas	5.0%
13	Environmental	19-4091	Environmental science and protection technicians, including health	4.8%
13	Environmental	19-2042	Geoscientists, except hydrologists and geographers	4.1%
13	Environmental	47-5081	Helpers--extraction workers	3.8%
13	Environmental	17-3025	Environmental engineering technicians	3.0%
13	Environmental	47-5013	Service unit operators, oil, gas, and mining	2.9%
14	Legal	23-1011	Lawyers	41.1%
14	Legal	43-6012	Legal secretaries	20.6%
14	Legal	23-2011	Paralegals and legal assistants	16.9%
14	Legal	23-2099	Legal support workers, all other	5.5%
14	Legal	23-2093	Title examiners, abstractors, and searchers	5.0%
14	Legal	23-2092	Law clerks	3.2%
14	Legal	23-1023	Judges, magistrate judges, and magistrates	2.0%
14	Legal	23-2091	Court reporters	1.3%
14	Legal	23-1021	Administrative law judges, adjudicators, and hearing officers	1.2%
14	Legal	25-1065	Political science teachers, postsecondary	1.1%

#	Competency Group	Occ Code	Occupation Title	Share of Cluster
15	Governance	43-5052	Postal service mail carriers	44.9%
15	Governance	43-5053	Postal service mail sorters, processors, and processing machine operators	27.0%
15	Governance	43-5051	Postal service clerks	10.2%
15	Governance	11-1031	Legislators	7.9%
15	Governance	25-1081	Education teachers, postsecondary	6.6%
15	Governance	11-9131	Postmasters and mail superintendents	3.4%
15	Governance	19-3094	Political scientists	0.6%
16	Education	25-2021	Elementary school teachers, except special education	20.3%
16	Education	25-9041	Teacher assistants	17.2%
16	Education	25-2031	Secondary school teachers, except special and vocational education	13.9%
16	Education	25-2022	Middle school teachers, except special and vocational education	8.7%
16	Education	25-3099	Teachers and instructors, all other	7.3%
16	Education	25-2011	Preschool teachers, except special education	4.8%
16	Education	25-1199	Postsecondary teachers, all other	3.7%
16	Education	25-2041	Special education teachers, preschool, kindergarten, and elementary school	2.9%
16	Education	11-9032	Education administrators, elementary and secondary school	2.9%
16	Education	25-1121	Art, drama, and music teachers, postsecondary	2.8%
17	Content	27-3031	Public relations specialists	63.8%
17	Content	27-3022	Reporters and correspondents	17.6%
17	Content	27-3011	Radio and television announcers	13.7%
17	Content	51-5023	Printing machine operators	7.7%
17	Content	25-4021	Librarians	5.9%
17	Content	25-4031	Library technicians	4.6%
17	Content	43-4121	Library assistants, clerical	4.2%
17	Content	27-3041	Editors	3.8%
17	Content	51-5022	Prepress technicians and workers	2.9%
17	Content	27-3012	Public address system and other announcers	2.7%
18	Customer Service	41-2031	Retail salespersons	14.7%
18	Customer Service	41-2011	Cashiers	11.8%
18	Customer Service	39-3091	Amusement and recreation attendants	9.3%
18	Customer Service	35-3021	Combined food preparation and serving workers, including fast food	7.8%
18	Customer Service	35-3031	Waiters and waitresses	7.7%
18	Customer Service	37-2011	Janitors and cleaners, except maids and housekeeping cleaners	7.1%
18	Customer Service	43-4181	Reservation and transportation ticket agents and travel clerks	6.4%
18	Customer Service	27-2022	Coaches and scouts	5.8%
18	Customer Service	41-4012	Sales representatives, wholesale and manufacturing, except technical and scientific products	4.9%
18	Customer Service	39-3031	Ushers, lobby attendants, and ticket takers	4.1%
19	Personal Service	49-9021	Heating, air conditioning, and refrigeration mechanics and installers	42.1%
19	Personal Service	51-6011	Laundry and dry-cleaning workers	38.1%
19	Personal Service	49-9031	Home appliance repairers	7.5%
19	Personal Service	49-9091	Coin, vending, and amusement machine servicers and repairers	6.9%
19	Personal Service	49-9094	Locksmiths and safe repairers	2.8%
19	Personal Service	49-9095	Manufactured building and mobile home installers	1.8%
19	Personal Service	49-9064	Watch repairers	0.5%

#	Competency Group	Occ Code	Occupation Title	Share of Cluster
19	Personal Service	49-9093	Fabric menders, except garment	0.4%
20	Back Office	43-9061	Office clerks, general	18.9%
20	Back Office	43-4051	Customer service representatives	13.0%
20	Back Office	43-6014	Secretaries, except legal, medical, and executive	11.0%
20	Back Office	43-6011	Executive secretaries and administrative assistants	9.1%
20	Back Office	43-1011	First-line supervisors/managers of office and administrative support workers	8.5%
20	Back Office	43-4171	Receptionists and information clerks	6.9%
20	Back Office	43-3071	Tellers	3.8%
20	Back Office	13-2072	Loan officers	2.1%
20	Back Office	43-9021	Data entry keyers	1.9%
20	Back Office	43-4199	All other information and record clerks	1.8%
21	Trade Skills	47-2031	Carpenters	15.6%
21	Trade Skills	47-2061	Construction laborers	15.6%
21	Trade Skills	47-2111	Electricians	10.1%
21	Trade Skills	47-1011	First-line supervisors/managers of construction trades and extraction workers	9.3%
21	Trade Skills	47-2152	Plumbers, pipefitters, and steamfitters	7.0%
21	Trade Skills	47-2073	Operating engineers and other construction equipment operators	6.3%
21	Trade Skills	47-2141	Painters, construction and maintenance	4.2%
21	Trade Skills	47-2051	Cement masons and concrete finishers	3.4%
21	Trade Skills	47-2211	Sheet metal workers	2.9%
21	Trade Skills	47-2081	Drywall and ceiling tile installers	2.1%

## APPENDIX IV: Industry Cluster Definitions

NES has presented data on several industry clusters in this report. To aid Metro Denver WIRED in synthesizing this report with its other analysis work relating to clusters, we provide the NAICS codes for the select clusters profiled in this report. Note that a NAICS code is only included in one cluster, not multiple clusters.

Industry Cluster	NAICS	NAICS Description
Aerospace	3364	Aerospace Product and Parts Manufacturing
Aerospace	9271	Space Research and Technology
Automotive	3361	Motor Vehicle Manufacturing
Automotive	3362	Motor Vehicle Body and Trailer Manufacturing
Automotive	3363	Motor Vehicle Parts Manufacturing
Automotive	3369	Other Transportation Equipment Manufacturing
Automotive	4231	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers
Back Office	5611	Office Administrative Services
Back Office	5612	Facilities Support Services
Back Office	5613	Employment Services
Back Office	5614	Business Support Services
Back Office	5617	Services to Buildings and Dwellings
Back Office	5619	Other Support Services
Medical	3254	Pharmaceutical and Medicine Manufacturing
Medical	3391	Medical Equipment and Supplies Manufacturing
Medical	4242	Drugs and Druggists' Sundries Merchant Wholesalers
Medical	6211	Offices of Physicians
Medical	6212	Offices of Dentists
Medical	6213	Offices of Other Health Practitioners
Medical	6214	Outpatient Care Centers
Medical	6215	Medical and Diagnostic Laboratories
Medical	6216	Home Health Care Services
Medical	6219	Other Ambulatory Health Care Services
Medical	6221	General Medical and Surgical Hospitals
Medical	6222	Psychiatric and Substance Abuse Hospitals
Medical	6223	Specialty (except Psychiatric and Substance Abuse) Hospitals
Medical	6231	Nursing Care Facilities
Medical	6232	Residential Mental Retardation, Mental Health and Substance Abuse Facilities
Medical	6233	Community Care Facilities for the Elderly
Medical	6239	Other Residential Care Facilities
Medical	6241	Individual and Family Services
Medical	6242	Community Food and Housing, and Emergency and Other Relief Services
Medical	6243	Vocational Rehabilitation Services
Medical	6244	Child Day Care Services
Content & Design	3231	Printing and Related Support Activities
Content & Design	4512	Book, Periodical, and Music Stores
Content & Design	4541	Electronic Shopping and Mail-Order Houses
Content & Design	4543	Direct Selling Establishments
Content & Design	5111	Newspaper, Periodical, Book, and Directory Publishers

Content & Design	5121	Motion Picture and Video Industries
Content & Design	5122	Sound Recording Industries
Content & Design	5151	Radio and Television Broadcasting
Content & Design	5152	Cable and Other Subscription Programming
Content & Design	5161	Internet Publishing and Broadcasting
Content & Design	5414	Specialized Design Services
Content & Design	5418	Advertising and Related Services
Electronics	3341	Computer and Peripheral Equipment Manufacturing
Electronics	3342	Communications Equipment Manufacturing
Electronics	3343	Audio and Video Equipment Manufacturing
Electronics	3344	Semiconductor and Other Electronic Component Manufacturing
Electronics	3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
Electronics	3346	Manufacturing and Reproducing Magnetic and Optical Media
Electronics	3359	Other Electrical Equipment and Component Manufacturing
Electronics	4236	Electrical and Electronic Goods Merchant Wholesalers
Electronics	4251	Wholesale Electronic Markets and Agents and Brokers
Electronics	8112	Electronic and Precision Equipment Repair and Maintenance
Energy	2111	Oil and Gas Extraction
Energy	2121	Coal Mining
Energy	2131	Support Activities for Mining
Energy	2211	Electric Power Generation, Transmission and Distribution
Energy	2212	Natural Gas Distribution
Energy	2213	Water, Sewage and Other Systems
Energy	3241	Petroleum and Coal Products Manufacturing
Energy	4235	Metal and Mineral (except Petroleum) Merchant Wholesalers
Energy	4247	Petroleum and Petroleum Products Merchant Wholesalers
Energy	4861	Pipeline Transportation of Crude Oil
Energy	4862	Pipeline Transportation of Natural Gas
Energy	4869	Other Pipeline Transportation
Finance	5211	Monetary Authorities - Central Bank
Finance	5221	Depository Credit Intermediation
Finance	5222	Nondepository Credit Intermediation
Finance	5223	Activities Related to Credit Intermediation
Finance	5231	Securities and Commodity Contracts Intermediation and Brokerage
Finance	5232	Securities and Commodity Exchanges
Finance	5239	Other Financial Investment Activities
Finance	5241	Insurance Carriers
Finance	5242	Agencies, Brokerages, and Other Insurance Related Activities
Finance	5251	Insurance and Employee Benefit Funds
Finance	5259	Other Investment Pools and Funds
Finance	5311	Lessors of Real Estate
Finance	5312	Offices of Real Estate Agents and Brokers
Finance	5313	Activities Related to Real Estate
Industrial Machinery	3331	Agriculture, Construction, and Mining Machinery Manufacturing
Industrial Machinery	3332	Industrial Machinery Manufacturing
Industrial Machinery	3333	Commercial and Service Industry Machinery Manufacturing
Industrial Machinery	3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing

Industrial Machinery	3335	Metalworking Machinery Manufacturing
Industrial Machinery	3336	Engine, Turbine, and Power Transmission Equipment Manufacturing
Industrial Machinery	3339	Other General Purpose Machinery Manufacturing
Industrial Machinery	4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers
Industrial Machinery	4238	Machinery, Equipment, and Supplies Merchant Wholesalers
Industrial Machinery	4239	Miscellaneous Durable Goods Merchant Wholesalers
Industrial Machinery	8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
IT	5112	Software Publishers
IT	5181	Internet Service Providers and Web Search Portals
IT	5182	Data Processing, Hosting, and Related Services
IT	5191	Other Information Services
IT	5415	Computer Systems Design and Related Services
Legal	5411	Legal Services
Legal	5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services
Metalworking	3311	Iron and Steel Mills and Ferroalloy Manufacturing
Metalworking	3312	Steel Product Manufacturing from Purchased Steel
Metalworking	3313	Alumina and Aluminum Production and Processing
Metalworking	3314	Nonferrous Metal (except Aluminum) Production and Processing
Metalworking	3315	Foundries
Metalworking	3321	Forging and Stamping
Metalworking	3322	Cutlery and Handtool Manufacturing
Metalworking	3323	Architectural and Structural Metals Manufacturing
Metalworking	3324	Boiler, Tank, and Shipping Container Manufacturing
Metalworking	3325	Hardware Manufacturing
Metalworking	3326	Spring and Wire Product Manufacturing
Metalworking	3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing
Metalworking	3328	Coating, Engraving, Heat Treating, and Allied Activities
Metalworking	3329	Other Fabricated Metal Product Manufacturing
Metalworking	3365	Railroad Rolling Stock Manufacturing
Non-Profits	8131	Religious Organizations
Non-Profits	8132	Grantmaking and Giving Services
Non-Profits	8133	Social Advocacy Organizations
Non-Profits	8134	Civic and Social Organizations
Non-Profits	8139	Business, Professional, Labor, Political, and Similar Organizations
Research	5416	Management, Scientific, and Technical Consulting Services
Research	5417	Scientific Research and Development Services
Resource Extraction	1131	Timber Tract Operations
Resource Extraction	1132	Forest Nurseries and Gathering of Forest Products
Resource Extraction	1133	Logging
Resource Extraction	1153	Support Activities for Forestry
Resource Extraction	2122	Metal Ore Mining
Resource Extraction	2123	Nonmetallic Mineral Mining and Quarrying