



Northeast Iowa

BUSINESS NETWORK

Regional Skillshed Analysis

A Study of Supply, Demand, and Skills Gaps
Released November 2012

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Introduction

This Skillshed Analysis brought together and analyzed information from three different sources; the Northeast Iowa Laborshed Survey, the Regional Workforce Needs Assessment (Job Vacancy) Survey, and information from the Occupational Information Network (O*NET). These three sources were used to present the supply and demand for labor within the region and the skills required to perform an occupation.

The Laborshed Survey was designed by the Institute for Decision Making (IDM) and conducted by NCS Pearson. Responses were collected by phone from a random sample of 18-64 year olds within the Allamakee, Clayton, Delaware, Fayette, Howard, and Winneshiek laborsheds. Respondents were asked a wide range of demographic and employment-related questions. Self-reported occupations of the respondents, place of residence, and information on commuting patterns were used from the survey.

Iowa Workforce Development conducted the second annual Workforce Needs Assessment Survey from October 2009 through October 2010. In addition to vacancy and retirement data, this year's survey included questions pertaining to average hourly starting wage and planned expansions or downsizing. Analysis of the survey illustrates the demand for workers and skills required in the workforce. This information can be used by economic developers, government leaders, educators, and state agencies to guide their decision making on issues related to workforce development, vocational training, and employee recruitment programs.

The Occupational Information Network (O*NET) is a joint effort between the US Department of Labor and the North Carolina Employment Security Commission. It provides a database of standardized and occupation-specific descriptions based on the Standard Occupational Classification (SOC Codes) that help determine which factors are critical in the performance of an occupation.

A skillshed is the geographic area from which a region pulls its workforce and the skills, education, and experience that the workforce possesses. Traditionally, labor markets have been studied in terms of the products produced by a region to understand what industries are relatively strong. A Skillshed Analysis helps to understand not only where the region's competitive strengths currently lie, by understanding the current workforce mix, but also in which occupations or industries could the region grow into by understanding the difference between the current skill set and that skill set needed by emerging markets.

The current skill set of the region was measured by translating the current jobs held by the workforce into a set of knowledge levels and work activities. Location quotients were also performed by occupational category to understand the current strengths of the region. By clustering the skill set of the current workforce, the emerging occupational categories that were statistically closest in skills and education can be mapped. It is into these categories that the region will be able to transition most effectively and efficiently.

The need for a Skillshed Analysis lies in the ability to match the current skills of the workforce with the skills needed in high-growth, high-pay jobs and to do so in the most efficient way possible. This is possible because the Skillshed Analysis matches the skills of the current workforce with the closest cluster of emerging occupations. In this way, a region can prepare for future occupational needs but do so spending the least amount of resources and placing fewer educational demands on its workforce.

Methodology for Analysis

Available Secondary Data

Both the Laborshed Survey and Workforce Needs Assessment are available through Iowa Workforce Development (IWD). The Occupational Information Network (O*NET) is available online and can be downloaded into a Microsoft Access database as well. All quantitative data and formulas are available in Microsoft Excel format.

Survey Research and Method

The Skillshed Analysis primarily relied on three data sources to provide the main data points for the analysis. These were the IWD Laborshed Survey, the IWD Workforce Needs Assessment Survey, and the Occupational Information Network (O*NET).

The Laborshed Survey, an employee survey, was designed by the Institute for Decision Making (IDM) at the University of Northern Iowa and conducted by NCS Pearson. A Laborshed is defined as the area or region from which an employment center draws its commuting workers. Surveys were conducted in each zip code based on a random sample of the population between 18 and 64 years of age and weighted by the total number of people in each zip code. Respondents were asked a wide range of demographic and employment-related questions. The purpose of Laborshed analysis is to measure the availability and characteristics of workers within the state on geographic principles. K means Clustering is then used to aggregate the population into groups of similar skills and education. Clustering techniques are statistical methods used to combine groups that share common areas. The K means Clustering technique does this by grouping the survey sample into groups that share common skills. The purpose is to use the Laborshed data as a proxy for the skills and geographical distribution of the current workforce.

The IWD Workforce Needs Assessment, an employer survey, was developed and conducted by the Iowa Workforce Development Regional Research & Analysis Bureau. It consists of questions about current and projected vacancies, employee retirement, benefits offered, and wage data. The goal of the survey is to assess the current and near-term hiring demand by industry and occupation throughout Iowa, and help to assess employers' perceptions of workforce skills and the effectiveness of advertising media. For the Skillshed Analysis, the percentage of vacant positions within each occupation relative to total employment is used to find the current hiring demand within each occupation. This data helps to narrow the field of possible occupations and occupational clusters from which to target recommendations and economic development.

The third data source used was the Occupational Information Network (O*NET). O*NET is an interactive application for exploring and searching occupational information. It was developed by the North Carolina Employment Security Commission in partnership with the US Department of Labor and the Employment and Training Administration. Through a continuing worker survey, O*NET develops and updates its database of the knowledge, work activities, abilities, and distinguishing characteristics of each occupation. It provides a directory of the work activities and knowledge areas needed for each occupation on a scale of one to seven and the importance of each work activity or knowledge area on a scale of one to five. Level one work activities or knowledge are the most basic and encompass such tasks as simple addition and repetition. Some level of training or education becomes necessary by level four, while level seven requires intense inferential thinking and usually post-graduate education. A list of level anchors and a corresponding estimate of the education or experience necessary is attached in Appendix A.

Though O*NET scales occupations across nine variables such as: abilities, skills, values, etc., two variables were used for the Skillshed study, knowledge areas and work activities required for each occupation. The knowledge variable encompassed 33 areas of knowledge such as: Administration and Management, Chemistry, Biology, Medical, Transportation, and Mathematics. These variables are closely related to the educational field in which one has studied. The work activity variable encompassed 41 activities such as: thinking creatively, working with others, interacting with computers, and repairing electronic equipment. These variables are more closely related to the skills one possesses and the experience they have gained from prior work.

The Purdue Center for Regional Development created the framework for the Occupational Clusters that was used in the study. The Purdue team used the five job zone categories developed by O*NET to distinguish occupations that require a higher level of education and experience. Zones one and two, the occupations requiring the least amount of preparation, were placed into two separate clusters. All other occupations were aggregated using Ward's hierarchical method to cluster like variables into 15 clusters by similar job tasks and responsibilities. The purpose of targeting these jobs is to show those occupations that rely more heavily on intellectual activity and skill, and presumably contribute to a faster pace of technical and economic advancement. Bureau of Labor Statistics (BLS) growth projections and median wage estimates were added to each occupation to help target those occupations and clusters with the greatest growth and income potential.

The 15 knowledge clusters along with the BLS projected employment and median wages are shown in Appendices C and D. The percentage of vacancies within each occupation relative to total vacancies, from the Workforce Needs Survey, was also added to the data to measure current hiring demand. The clusters were then analyzed to find those with high overall projected growth, current demand, and an above average median wage. These findings could then be used with regional occupational trend analysis and competitive structure to select the occupational clusters which would be used in gap analysis with the current skill set of the population.

Findings

The statewide analysis of the Laborshed Study is composed of 6,000 responses from individuals in the State of Iowa. Responses were extracted from the Statewide Laborshed database of 14,744 surveys conducted between January 2009 and March 2010. Regionally, 1,894 responses were collected from the Northeast Iowa Business Network.

Of the 40,884 firms in the population, 8,179 took part in the Workforce Needs Assessment survey, with 456 responses of the 1,383 mailed within the region, the Northeast Iowa Business Network the response rate was 33.0%.

The study, and subsequent recommendations, has focused on broader occupational groupings rather than on the individual occupations themselves. For the Laborshed Study and Workforce Needs Assessment, this was done to increase the sample size within each group, thus, increasing the validity of the data. The 2011 Northeast Iowa Business Network Laborshed had 1,894 respondents, but each occupation may only have been represented by a few respondents. The number of respondents in each occupation averaged approximately one-third of a percent of the total, or about 5 respondents. At the categorical level, however, there was an average of 65 respondents or 4.5 percent of the total which meant that the difference of a few respondents would not dramatically skew the outcome. While it may be more efficient to concentrate resources toward a single occupation or a small group of occupations, the study decided to examine the Skillshed at the occupational cluster level. Because of the methodology used to group the occupations into clusters, the occupations within each cluster are similar in terms of skills needed and tasks performed. By focusing on the training and educational needs of the cluster as a whole, the region can help nurture economic development in the area but allow market forces and worker preference to decide the precise occupational mix.

A location quotient and change in quotient is developed by comparing the 2005 and 2011 Laborsheds for the region (**Table 1**). From our analysis, further attention would be given to those occupational categories with a 2011 location quotient of 1.00 or higher, meaning the relative concentration of employment in that occupational field is greater than it is statewide, pointing to possible regionally-specific advantages that favor growth in the

Table 1
Location Quotient Northeast Iowa Business Network

Occupational Category	Location Quotient 2005	Location Quotient 2011	Change in Location Quotient
Computer & Mathematical	0.39	1.65	1.27
Building and Grounds Cleaning and Maintenance	1.25	1.47	0.23
Farming, Fishing, and Forestry	1.86	1.37	-0.48
Production	1.29	1.30	0.01
Construction and Extraction	1.21	1.27	0.06
Healthcare Practitioners	0.81	1.19	0.38
Healthcare Support	1.17	1.13	-0.04
Community and Social Services	0.91	1.13	0.22
Management	1.10	1.13	0.02
Sales and Related	0.94	1.07	0.13
Food Preparation and Serving	1.11	1.05	-0.06
Education, Training, and Library	1.00	1.00	0.00
Legal	0.67	0.97	0.30
Life, Physical, and Social Science	0.52	0.93	0.41
Office and Administrative Support	0.89	0.92	0.03
Protective Services	0.56	0.91	0.34
Installation, Maintenance, and Repair	0.96	0.87	-0.09
Personal Care and Services	1.21	0.86	-0.35
Transportation and Material Moving	1.15	0.82	-0.33
Arts, Design, Entertainment, Sports, and Media	0.70	0.56	-0.14
Architecture & Engineering	0.99	0.53	-0.46
Business and Financial Operations	0.57	0.01	-0.56

Supply of Workers

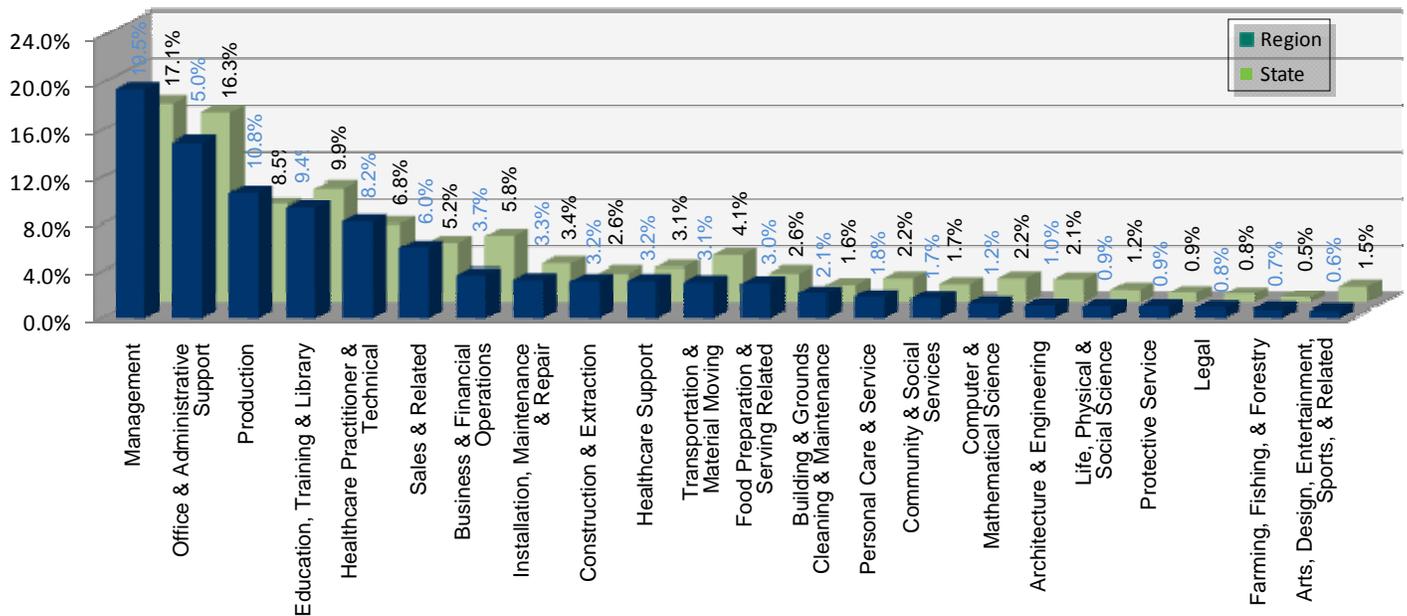
Table 2 shows the top jobs held by percentage of workers within the region. The percent of workers in the occupation statewide and the projected annual growth rate is also given. This data can help show in which occupations the region has a large pool of workers and in where the region's skill set may lie in comparison to the statewide workforce. The top five occupations held in the region are: general & operational managers (6.1%); teachers & instructors (5.0%); production workers (4.0%); registered nurses (3.4%); and managers (2.8%).

Table 2
Occupational Experience in Region

Occupation	SOC Code	Percent of Region ²	Percent of State ³	Statewide Projected Annual Growth Rate ¹
General and Operations Managers	11-1021	6.1%	1.6%	0.0%
Teachers and Instructors, All Other	25-3099	5.0%	5.7%	1.4%
Production Workers, All Other	51-9199	4.0%	2.5%	0.6%
Registered Nurses	29-1111	3.4%	3.2%	2.2%
Managers, All Other	2666211	2.8%	4.1%	0.8%
Farmers and Ranchers	2597911	2.7%	1.9%	-0.2%
Chief Executives	11-1011	2.4%	4.3%	-0.1%
First-Line Supervisors and Managers of Office and Administrative Support Workers	43-1011	2.4%	2.6%	1.2%
Executive Secretaries and Administrative Assistants	43-6011	2.3%	3.1%	1.2%
Teacher Assistants	25-9041	1.8%	1.9%	0.9%
First-Line Supervisors/Managers of Production and Operating Workers	51-1011	1.6%	1.3%	0.2%
Bookkeeping, Accounting, and Auditing Clerks	43-3031	1.5%	1.2%	1.1%
Customer Service Representatives	43-4051	1.5%	1.7%	2.4%
Nursing Aides, Orderlies, and Attendants	31-1012	1.5%	1.2%	1.9%
Sales and Related Workers, All Other	41-9099	1.4%	0.8%	0.7%

The occupations listed above can also be analyzed by overall occupational category. The following chart presents the occupational categories for the region. The region has a high relative concentration of workers in the management, office & administrative support, and production occupational categories which are similar to the percentages of these categories held statewide: management (17.1%), office & administrative support (16.3%), and production (8.5%).

Chart 1
Population by Occupational Category



¹ <http://win.iwd.state.ia.us/pubs/region01/region01occproj.pdf>

² Northeast Iowa Laborshed Survey (2011)

³ Iowa Laborshed Survey (2010)

Commuting and Willingness to Change/Accept Employment

The Laborshed Study also presents data on the commuting patterns and the willingness to change and/or accept employment. On average, workers within the region currently commute 10 miles each way to work for a median wage of \$14.50 per hour and would be willing to commute up to 14 miles for a desired median wage of \$14.00 per hour.

Over one-fourth (26.2%) of the employed are willing to change employment and almost three-fourths (71.5%) of those reporting to be unemployed are willing/able to accept employment within the region. Commuting ranges and the willingness to change and/or accept employment could have an impact on economic development as the region covers a relatively large area and the majority are rural communities.

Demand for Workers

The Workforce Needs Assessment reveals the vacant jobs employers reported in the region. **Table 3** shows the occupations with the most reported vacancies, the average starting wage, and the median regional wage. An overlap can be seen when comparing the occupations with the most vacancies and the occupational experience in the region.

Demand for workers also helps to show the current demand for skills and education within the region. By using the occupations as a proxy for skills and education need, the current vacancies can be translated to needed skill sets. These needed skill sets can then be analyzed with projected growth in occupations and wages. When analyzing employer needs and economic growth within a region, it is important to see which jobs are in high-demand currently, which jobs are projected to grow in the future, and whether any overlap occurs between currently demanded occupations and those with high projected growth rates.

Table 3
Occupations with Most Vacancies

Job Title	SOC Code	Regional Starting Wage ¹	Statewide Entry Level Wage ²	Statewide Median Wage ²
Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers	33-9092	\$ 7.50	\$ 7.96	\$ 8.40
Recreation Workers	39-9032	\$ 14.17	\$ 8.27	\$ 9.67
Coaches and Scouts	27-2022	\$ 12.28	\$ 7.86	\$ 9.03
Teachers and Instructors, All Other	25-3099	\$ 19.05	\$ 10.72	\$ 13.46
Nursing Aides, Orderlies, and Attendants	31-1012	\$ 9.55	\$ 9.78	\$ 11.44
Production Workers, All Other	51-9199	\$ 11.00	\$ 9.37	\$ 13.42
Executive Secretaries and Administrative Assistants	43-6011	\$ 8.48	\$ 13.35	\$ 18.15
Registered Nurses	29-1111	\$ 20.05	\$ 19.18	\$ 24.44
Rehabilitation Counselors	21-1015	\$ 10.36	\$ 9.44	\$ 12.38
Cooks, All Other	35-2019	\$ 7.80	\$ 8.60	\$ 10.65
Managers, All Other	11-9199	\$ 17.52	\$ 19.19	\$ 34.48
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	51-4122	\$ 13.00	\$ 13.09	\$ 16.09

¹ Northeast Iowa Business Network Workforce Needs Assessment (2011)

² <http://www.iowaworkforce.org/lmi/occupations/wages/index.htm>

Table 4 shows the largest industries in the region (by employment), and the vacancies most reported by those industries. The wholesale and retail trade industries have been combined due to the similarity in occupational mix.

In some instances, employers may have difficulty filling a vacancy in one industry but can fill the same occupation in another industry quite easily. Aside from differences in starting wages, these cases can occur because basic work duties and educational requirements may be similar across industries, but the work environment may be different and applicants may need some industry specific knowledge. Other occupations may be equally difficult to fill across industries. By examining the occupations demanded across industries, we can begin to see a demand picture for occupational categories. For example, Recreation Workers are in high demand in both the Public Administration and Education industries. Though not shown among the most reported vacancies, occupations within administration and management are also commonly shared across industries.

Employers in the region reported requiring less experience and fewer years of formal education for their vacancies than those levels generally reported on O*NET or other occupational planning sources. This indicates that employers are willing to work with applicants to develop the skills and knowledge for the job rather than demanding that an applicant possess all skills at the outset. This information is also important to economic developers because it shows an approximate level of education and experience required by the occupations with reported vacancies. This level of education or experience can be compared to the actual levels possessed by the population on average.

**Table 4
Top Jobs Within Region's Largest Industries**

Industry	Occupation	Average Education Requirement	Average Experience Requirement	Average Starting Wage ³
Education	Coaches and Scouts	*	1-2 years	\$ 10.85
	Teachers & Instructors, All Others	Bachelor Degree	3-5 years	\$ 21.76
	Recreation Workers	Bachelor Degree	1-2 years	\$ 17.50
Health Care & Social Services	Rehabilitation Counselors	Bachelor Degree	3-5 years	\$ 10.36
	Nursing Aides, Orderlies, and Attendants	Associate Degree	No Experience Needed	\$ 9.55
	Executive Secretaries and Administrative	Associate Degree	1-2 years	\$ 8.62
	Registered Nurses	Technical Training/Certification	3-5 years	\$ 20.05
Manufacturing	Machinists	Technical Training/Certification	1-2 years	\$ 12.00
	Production Workers, All Other	High School Diploma/GED	No Experience Needed	\$ 10.50
	Welding, Soldering, & Brazing Machine	Technical Training/Certification	1-2 years	\$ 13.00
Wholesale & Retail Trade	Food Preparation & Serving Related	High School Diploma/GED	No Experience Needed	\$ 7.25
	Retail Salespersons	High School Diploma/GED	No Experience Needed	\$ 10.00
	Truck Drivers, Heavy & Tractor-Trailer	Technical Training/Certification	1-2 years	\$ 7.75
Public Administration	Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers	High School Diploma/GED	No Experience Needed	\$ 7.50
	Recreation Workers	Bachelor Degree	1-2 years	\$ 7.50

³ Iowa Workforce Needs Assessment Survey (2011)

Table 5 presents a sample of high growth occupations, their projected annual growth rates, and median wages for the state. These data (projected employment 2008-2018) represent the occupations that are most likely to experience growth throughout the state based on current employment. Industry projections, from the Iowa Workforce Information Network, for the same time period show growth by percent employment change in internet service providers (50.7%); other information services (44.1%); professional, scientific, and technical services (32.6%); and ambulatory health care services (30.0%)².

**Table 5
Regional High Growth Occupations**

Occupation	Projected Annual Growth Rate ¹	Statewide Median Wage ¹
Network Systems and Data Communications Analysts	5.4%	\$ 31.75
Financial Examiners	4.4%	\$ 32.65
Medical Scientists, Except Epidemiologists	4.3%	\$ 32.27
Home Health Aides	4.3%	\$ 10.50
Personal and Home Care Aides	4.0%	\$ 9.60
Personal Financial Advisors	3.8%	\$ 25.08
Physician Assistants	3.5%	\$ 39.50
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	3.4%	\$ 19.46
Computer Software Engineers, Applications	3.4%	\$ 35.03
Veterinary Technologists and Technicians	3.2%	\$ 13.89
Computer Software Engineers, Systems Software	3.1%	\$ 37.02
Dental Hygienists	3.1%	\$ 31.00
Dental Assistants	3.1%	\$ 16.11
Compliance Officers, Except Agriculture, Construction, Health and Safety	3.1%	\$ 23.08

The average projected annual occupational growth projections for the state is .98 percent. Jobs with a negative annual projected employment growth should be studied to see which skills or training would be necessary to move workers into the occupations that show more future job growth.

Table 6 shows a sample of occupations with negative or low growth, their projected annual growth rates (projected employment 2008-2018) throughout the state based on current employment, and median wages for the region. Industry projections for the same time period, show a negative growth by percent employment change in textile product mills (-35.1%); apparel manufacturing (-28.9%); leather & applied product manufacturing (-19.4%); and support activities for mining (-14.3%). All reported manufacturing industries have an average projected decline of -1.9 percent. This is well below the average for all industries of 7.4 percent over the ten year period, further emphasizing the need for making the transition into advanced manufacturing.

**Table 6
Regional Declining and Low Growth Occupations**

Occupation	Projected Annual Growth Rate ¹	Statewide Median Wage ¹
Postal Service Mail Sorters, Processors, & Processing Machine Operators	-3.0%	\$ 24.97
Order Clerks	-2.5%	\$ 14.47
File Clerks	-2.3%	\$ 9.58
Weighers, Measurers, Checkers, and Samplers, Recordkeeping	-1.4%	\$ 14.11
Metal Workers and Plastic Workers, All Other	-1.3%	\$ 15.93
Conveyor Operators and Tenders	-1.2%	\$ 12.90
Gaming Change Persons and Booth Cashiers	-1.2%	\$ 11.34
Information and Record Clerks, All Other	-1.1%	\$ 16.36
Office and Administrative Support Workers, All Other	-1.1%	\$ 11.51
Paper Goods Machine Setters, Operators, and Tenders	-1.0%	\$ 15.87
Switchboard Operators, Including Answering Service	-0.9%	\$ 11.46
Telemarketers	-0.8%	\$ 10.34
Payroll and Timekeeping Clerks	-0.8%	\$ 16.54
Chemical Plant and System Operators	-0.8%	\$ 21.59

¹ <http://win.iwd.state.ia.us/pubs/region01/region01occproj.pdf>
² <http://win.iwd.state.ia.us/pubs/statewide/indprojstatewide.pdf>

category.

The final selection of target occupational clusters was based on three points: (1) current workforce needs as measured by percentage of vacancies within the occupational cluster relative to total vacancies, (2) BLS employment growth projections and median wages, and (3) the Laborshed trend analysis. By basing the selection on these three criteria, it is hoped that economic or educational responses to the study will satisfy some fundamental ideas. One, by promoting training and education in occupations that are currently in high demand, the region can help move the markets for these occupations closer toward equilibrium, reducing employment search costs for businesses and potentially consumer costs for the products or services. Two, Laborshed trend analysis helps us to discover the path of least resistance for the region. These occupational categories are already relatively more concentrated or growing at a faster pace than elsewhere and have the benefit of momentum and competitive advantage. It is more likely that resources spent in these groups can have a larger effect and can be more quickly implemented. Finally, by narrowing the field to those occupational categories with higher than average growth and median wages more economic value can be added to the region.

The trend analysis showed the region’s relative employment concentration in computer & mathematical; building & grounds cleaning and maintenance; farming, fishing, & forestry; production; construction & extraction; and healthcare practitioners is fairly large and that all of the categories except farming, fishing, & forestry experienced an increase in concentration from 2005 to 2011.

After the regional trend analysis, occupational clusters with an above average overall growth projection of more than 1.0 percent and an average hourly median wage above \$18.00 were selected for further criteria. After analyzing the occupational clusters according to the projected growth, median wage, and vacancy rate criteria the occupational clusters with the most potential were Advanced Manufacturing, Information Technology, and Healthcare.

The three occupational clusters analyzed, comprised of 127 occupations, were then translated into skill sets required to perform each occupation as defined by the O*NET knowledge and work activity measures. A minimum, average, and maximum level for each knowledge and work activity variable was calculated for each occupational cluster. From the importance estimate for each knowledge or work activity variable, a list of critical skill areas needed within each occupational cluster was developed. An importance estimate of 3.25 or higher for a knowledge variable or a 3.75 or higher for a work activity variable was necessary to designate that variable as critical to the occupational cluster. The three occupational clusters are described more thoroughly in the findings section.

Twenty-two variables were found to be critical to the occupations within the occupational clusters of the emerging occupations. **Tables 7 and 8** show the work activities and knowledge areas critical to the selected occupational clusters. By focusing on these critical knowledge areas and skills, the subgroups within the current workforce that are well-suited to the groups can be targeted for transition to the occupations that will drive the 21st century economy and better spend resources on the education and skills needed to help the workforce make the transition.

**Table 7
Critical Work Activities**

Work Activities
Assisting and Caring for Others
Communication with Supervisors, Peers, or Subordinates
Documenting and Recording Information
Establishing and maintaining Interpersonal Relationships
Getting Information
Identifying Objects, Actions, or Events
Inspecting Equipment, Structures, or Material
Interacting with Computers
Making Decisions and Problem Solving
Updating and Using relevant Knowledge

**Table 8
Critical Knowledge Areas**

Knowledge
Administration and Management
Computers & Electronics
Customer Service
Design
Engineering & Technology
English Language
Mathematics
Mechanical
Medicine & Dentistry
Psychology
Telecommunications
Therapy & Counseling

These critical variables across each occupational cluster were then examined to find which variables were distinct to each occupational cluster and which were shared. The Healthcare occupational cluster had six critical variables that were also unique to the occupational cluster: knowledge in Medicine & Dentistry, Therapy & Counseling, and Psychology and within the work activities of Assisting & Caring for Others; Establishing & Maintaining Interpersonal Relationships; and Documenting & Recording Information. The Information Technology occupational cluster had four critical and unique variables: knowledge in Computers & Electronics, and Telecommunications and within the work activity of Identifying Objects, Actions, or Events and Interacting with Computers. The Advanced Manufacturing occupational cluster had four critical variable exclusive to the occupational cluster in the knowledge areas of Design, Mechanical, and Administration & Management and within the work activity of Inspecting Equipment, Structures, or Materials. There were five critical variables shared by all three of the occupational clusters: knowledge in English Language and Customer Service and within the work activities of Communicating within the Organization, Getting Information, and Making Decisions & Problem Solving.

Using the skills needed in the 33 knowledge areas and the 41 work activities for each occupation as defined by O*NET, each Laborshed respondent was translated into their appropriate skill set depending on their current and previous occupation, and their field of education. This gave us three possible skill sets for each person in the survey sample depending on their occupational history and education. For example: for the knowledge variable Medicine and Dentistry a person may have a knowledge level of 4.52 from their current job as a nurse, a level of 2.44 from a previous career as a Home Health Aide, or a level of 2.04 from their education in general business administration. These three sets were then aggregated into one skill set per person by taking the highest level from each variable by assuming that skill levels are fairly enduring once achieved. Two clustering techniques were considered to aggregate the population for best fit. By clustering the current population into groups, it can be better seen in which knowledge areas and work activities the population has a relatively high skill level. A minimum, average, and maximum skill level profile was then computed for each population cluster, and the relative strengths across the knowledge and work activity variables were analyzed to find best fit with one of the three targeted occupational clusters.

Gap analysis was performed by comparing the population clusters with their respective occupational cluster. First the current skill set of the workforce was analyzed. The K means clustering technique clustered the population according to where they best fit in one of the three occupational clusters: Healthcare, Information Technology, and Advanced Manufacturing. The complete analysis is provided in Appendix E.

An interesting point seen from the data is the difference between the skill set of the population as a whole and the skill set when the population is clustered according to their strongest attributes. If the population is considered as one group and the average skill level of the areas critical to the job groups are computed, it is found that the group has an average skill level of 2.57. However, when the population is clustered into groups according to their strength in critical variables important to one of the three target occupational clusters, and then measure average skill levels for the variables critical only to that occupational cluster, it is found that the average skill level increases to 3.75. This means that, by strategically targeting those clustered portions of the population for occupational cluster specific training, the region can significantly improve its probability of success in achieving a workforce that meets the skills needs for occupational cluster.

Another interesting point from the data is that, when the clustered population's average skill level is further separated into their average skill level in knowledge-related variables and work activity-related variables, the population consistently shows a higher skill level in the work activity variables. From the occupational clusters an inventory of necessary education and experience was created based on the level of knowledge and work activity needed in the critical areas. This helped us to understand the basic requirements throughout the occupational clusters. The minimum and average skill levels in the critical skill areas were compared to those levels necessary for the occupational cluster. This provided the gap between the average skill level of the clustered population to that of the average skill level needed for the occupational clusters. Knowing these gaps and in which knowledge or work activity variables they exist helps us to estimate education or training needed. Formal education required to move from level to level was estimated with the level anchors provided by O*NET.

Analysis of the Healthcare Cluster

The health care field is undeniably one of the most important industries in the country. Whether it is directly assisting individual patients and their families, or working in clinical laboratories, or specializing in the organization and retention of medical records, workers in the health care industry provide goods and services that benefit nearly everyone at some time or another. As medical knowledge and techniques progress allowing Americans to live longer, and as a large percentage of the nation's population reaches an advanced age, it is no surprise that jobs within the health care industry have been steadily increasing in numbers and are projected to continue doing so in the future.

As indicated above, the positions available within the health care industry are widely varied in their focus and responsibilities. While most people think of health care positions that feature a heavy focus on customer service due to their amount of direct contact with patients and families, there are also many positions with an acute

focus on science and technology, such as lab technicians and medical researcher positions. This broad range of opportunities predictably attracts a similarly broad range of applicants to the industry. Once employed within the industry; however, workers are often able to change positions relatively easily, due to many jobs within the industry sharing a good deal of education, skills, and training. This is not to say; however, that health care workers will not need additional education and/or training to progress within the industry. Quite the opposite, in fact, as the field is constantly changing with new research findings and technologies.

The Bureau of Labor Statistics' (BLS) Standard Occupational Classification (SOC) system identifies numerous job titles that fall within the health care occupational cluster. For our purposes, the job titles (and corresponding SOC codes) that we will be including in our analysis of the health care group are as follows: physician assistants (29-1071) under the subheading healthcare & medical science (medical practitioners and scientists); radiation therapists (29-1124), cardiovascular technologists & technicians (29-2031), and dental hygienists (29-2021) under the subheading healthcare & medical science (medical technicians); registered nurses (29-1111), and physical therapists (29-1123) under the subheading healthcare & medical science (therapy, counseling, nursing, and rehabilitation). These particular job titles were chosen based upon their combination of relatively high projected employment growth, median salaries, and current vacancy needs.

Using survey data received from employers, it is possible to determine which knowledge areas and work activities would be most beneficial to applicants looking for work in the healthcare cluster. According to the data for this industry and these positions, it is most beneficial for applicants to have knowledge in customer & personal service, english language, medicine & dentistry, psychology, and therapy & counseling. Also, it is beneficial for applicants to have work experience in assisting & caring for others; communication with supervisors, peers, or subordinates; documenting & recording information; establishing & maintaining interpersonal relationships; getting information; making decisions & solving problems; and updating & using relevant knowledge.

From the sample population of 1,894 respondents, 414 respondents (21.9% of the population) were clustered into the healthcare occupational cluster. The cluster had an average skill level of 3.12 in the critical knowledge variables and an average skill level of 3.98 in the work activity variables critical to occupations in healthcare, and an average level of 2.45 in all knowledge and work activity variables. When compared to the target cluster of occupations as shown below, with an average occupational skill level across the knowledge critical variables of 4.12 and 4.72 in the critical work activity variables, it is seen that the clustered population group needs education and training in both the knowledge variables and the work activities.

From **Table 9**, one can see that the portion of the population that were clustered as being skilled in those variables critical to healthcare currently have a knowledge skill level of about 3.62, or just above a high school level of understanding in the areas critical to jobs in the field. The level of understanding needed, on average, for occupations in the healthcare occupational cluster is around a 4.47, or just above an associate degree level of understanding. Those knowledge areas in which the population is most in need of supplemental training are: medicine & dentistry, therapy & counseling, and psychology. As with the other population clusters, the population does not need a great deal of training in the experiential work activity variables. The only areas of

**Table 9
Skills Gap for Healthcare Population Cluster**

Critical Skill & Knowledge Needs	Population Cluster	Average Level Needed	Gap
Therapy & Counseling	2.39	3.72	-1.33
Medicine & Dentistry	2.36	3.63	-1.27
Updating and Using relevant Knowledge	3.98	5.05	-1.07
Documenting and Recording Information	3.39	4.31	-0.92
Psychology	3.46	4.37	-0.91
Making Decisions and Problem Solving	3.82	4.72	-0.90
Customer Service	4.10	4.89	-0.79
Getting Information	3.97	4.68	-0.71
English Language	3.31	4.01	-0.70
Assisting and Caring for Others	4.19	4.88	-0.69
Establishing and maintaining Interpersonal Relationships	4.47	4.93	-0.46
Communicating with persons inside organization	4.04	4.48	-0.44
<i>Average Critical Variables</i>	3.62	4.47	
<i>Average all Variables</i>	2.45	2.96	
<i>Average Knowledge Variables</i>	3.12	4.12	
<i>Average Work Activity Variables</i>	3.98	4.72	

need in the work activity variables was in the areas of updating & using relevant knowledge, and documenting & recording information.

Table 10 shows related occupations to the Healthcare occupations, median wages, skills and knowledge areas shared by the occupations, and areas in which skills or knowledge need upgrading to satisfy the needs of the occupation within the target cluster. Generally, it is better to design pathways from occupations outside of the occupational cluster and with lower median wages and growth rates than the target occupation. For the Healthcare cluster, as with some other occupational groups that are highly specialized, it may be necessary to fill vacancy needs by up-training those already in the group. Though nursing aides, orderlies, & attendants is a

**Table 10
Related Occupations to Healthcare**

Related Occupations		Median Wages	Overlapping Skills and Education	Required Areas for Improvement	
Healthcare	Emerging Occupation: Registered Nurse	\$ 24.44			
	Career Pathways	Nursing Aides, Orderlies, and Attendants	\$ 11.44	Customer and Personal Service; Handling and Moving Objects	Biology; Therapy and Counseling; Provide Consultation and Advice to Others; Communicating with Persons Outside Organization
		Teacher's Assistants	\$ 9.73	Clerical; Interpreting the Meaning of Information for Others	Medicine and Dentistry; Customer and Personal Service; Handling and Moving Objects; Inspecting Equipment, Structures, or Material
		Information and Records Clerks	\$ 16.36	Clerical; Processing Information	Medicine and Dentistry; Psychology; Handling and Moving Objects; Assisting and Caring for Others
	Emerging Occupation: Physical Therapist	\$ 33.58			
	Career Pathways	Occupational Health and Safety Technicians	\$ 27.32	Psychology; Communicating with Persons Outside Organization	Medicine and Dentistry; Biology; Handling and Moving Objects; Estimating the Quantifiable Characteristics of Products, Events, or Information
		Recreation Workers	\$ 9.67	Clerical; Communicating with Persons Outside Organization	Therapy and Counseling; Medicine and Dentistry; Evaluating Information to Determine Compliance with Standards; Monitor Processes, Materials, or Surroundings
Office & Administrative Support Workers, All Other		\$ 11.51	Clerical; Organizing, Planning, and Prioritizing Work	Therapy and Counseling; Psychology; Handling and Moving Objects; Performing General Physical Activities	

*Skills data available through O*Net (www.onetcenter.org)*

highly demanded job, it is also an occupation from which workers can supply the demands for registered Nurses. Although nurse aides need the required formal education to become nurses, they already possess much of the experiential needs.

Analysis of the Advanced Manufacturing

Advanced manufacturing is one of the broadest and most versatile industries in today's economy. From textiles to electronics to machinery to foods and beverages, nearly everything we use day in and day out is a product of advanced manufacturing. And, the techniques used to manufacture the products we use are as varied as the products themselves. The industry's versatility is due largely to its ability to harness and implement the latest technologies into their techniques. Automation and robotics have made the industry more efficient and more accurate. Computers and software have revolutionized quality control and process monitoring. Communications technology has simplified and expedited the flow of information and data across the country and around the world. When these technologies and resources are combined with the ingenuity and expertise of a qualified workforce, the advanced manufacturing industry has shown the ability to continually impress consumers and improve their quality of living at an ever-increasing rate.

Much like its techniques and products, the workforce of the advanced manufacturing industry is also very versatile. With jobs available in areas of production, design, and engineering (to name but a few), the industry offers career paths to workers with a wide variety of interests and skills. The Bureau of Labor Statistics' (BLS) Standard Occupational Classification (SOC) system identifies numerous job titles that fall within the advanced manufacturing industry. For our purposes, the job titles (and corresponding SOC codes) that we will be including in our analysis of the advanced manufacturing industry are as follows: logisticians (13-1081), mechanical engineers (17-2141), electrical & electronics repairers, commercial & industrial equipment (49-2094), electrical power-line installers & repairers (49-9051), industrial machinery mechanics (49-9041), medical equipment repairers (49-9062), civil engineers (17-2051), industrial engineers (17-2112), biomedical engineers (17-2031), environmental engineers (17-2081), and commercial & industrial designers (27-1021). These particular job titles were chosen based upon their combination of relatively high projected employment growth, median salaries, and current vacancy needs.

¹ <http://win.iwd.state.ia.us/pubs/region01/region01occproj.pdf>

According to Purdue University’s Center for Regional Development, the job titles listed above are drawn from a variety of knowledge clusters. These clusters are meant to group job titles (and their corresponding SOC codes) logically by the skills necessary to perform them. Using these knowledge clusters, the BLS is able to make projections which offer more detailed information about the future of the job market for a large number of job titles. For this study, knowledge clusters were used for guidance but were circumvented, when necessary, to form an accurate picture of the desired industries. For example, the advanced manufacturing industry includes job titles from multiple BLS knowledge clusters, ranging from “Managerial, Sales, Marketing & Human Resources” to “Engineering & Related Sciences.”

Using survey data received from employers, we were able to determine which Knowledge Areas and Work Activities would be most beneficial to applicants looking for work in the advanced manufacturing industry. According to the data for this industry and these positions, it is most beneficial for applicants to have knowledge in Design, Engineering & Technology, English Language, Mathematics, and Mechanical Operations. Also, it is beneficial for applicants to have work experience in Communication with Supervisors, Peers, or Subordinates, Getting Information, Identifying Objects, Actions, and Events, Making Decisions & Solving Problems, and Updating & Using Relevant Knowledge.

From the sample population of 1,894 respondents, 520 respondents (27.5% of the population) were clustered into the Advanced Manufacturing occupational cluster. The cluster had an average skill level of 3.27 in the critical knowledge variables and an average skill level of 3.97 in the work activity variables critical to occupations in Advanced Manufacturing, and an average level of 2.86 in all knowledge and work activity variables. When compared to the target cluster of occupations as shown below, with an average occupational skill level across the knowledge critical variables of 3.58 and 3.81 in the critical work activity variables, it is seen that the clustered population group needs education and training in both the knowledge variables and the work activities.

From **Table 11**, one can see that the portion of the population that were clustered as being skilled in those variables critical to advanced manufacturing currently have a knowledge skill level of about 3.27, or just above a high school level of understanding in the areas critical to jobs in the field. The level of understanding needed, on average, for occupations in the advanced manufacturing occupational cluster is around a 3.58, or between a

**Table 11
Skills Gap Advanced Manufacturing**

Critical Skill & Knowledge Needs	Population Cluster	Average Level Needed	Gap
Mechanical	3.15	4.82	-1.67
Engineering & Technology	2.33	3.55	-1.22
Design	2.38	3.41	-1.03
Inspecting Equipment, Structures, or Material	3.00	3.67	-0.67
Mathematics	3.79	3.66	0.13
Communication with Supervisors, Peers, or Subordinates	4.34	3.99	0.35
Making Decisions & Problem Solving	4.51	4.06	0.45
English Language	3.39	2.94	0.45
Administration and Management	3.92	3.46	0.46
Getting Information	4.02	3.50	0.52
Customer Service	3.90	3.20	0.70
<i>Average Critical Variables</i>	<i>3.52</i>	<i>3.66</i>	
<i>Average all Variables</i>	<i>2.86</i>	<i>2.64</i>	
<i>Average Knowledge Variables</i>	<i>3.27</i>	<i>3.58</i>	
<i>Average Work Activity Variables</i>	<i>3.97</i>	<i>3.81</i>	

high school and associate degree level of understanding. Those knowledge areas in which the population is most in need of supplemental training are: mechanical, engineering & technology, and design.

Table 12 shows related occupations to the Advanced Manufacturing occupations, median wages, skills and knowledge areas shared by the occupations, and areas in which skills or knowledge need upgrading to satisfy the needs of the occupation within the target cluster. Generally, it is better to design pathways from occupations outside of the occupational cluster and with lower median wages and growth rates than the target occupation.

**Table 12
Related occupations to Advanced Manufacturing**

Related Occupations		Median Wages	Overlapping Skills and Education	Required Areas for Improvement	
Advanced Manufacturing	Emerging Occupation: Electrical and Electronics Repairers, Commercial and		\$ 26.94		
	Career Pathways	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	\$ 10.62	Building and Construction, Controlling Machines and Processes	Computers and Electronics, Mechanical, Processing Information, Repairing and Maintaining Electronic Equipment
		Landscaping and Groundskeeping Workers	\$ 11.04	Building and Construction, Controlling Machines and Processes	Mathematics, Computers and Electronics, Repairing and Maintaining Electronic Equipment, Communicating inside the Organization
		Industrial Truck and Tractor Operators	\$ 14.33	Production and Processing, Controlling Machines and Processes	Computers and Electronics, Mechanical, Repairing and Maintaining Electronic Equipment, Communicating inside the Organization
	Emerging Occupation: Industrial Machinery Mechanics		\$ 20.22		
	Career Pathways	Maintenance and Repair Workers, General	\$ 16.35	Building and Construction; Monitor Processes, Materials, or Surroundings	Mathematics; Engineering and Technology; Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment; Controlling Machines and Processes
		Team Assemblers	\$ 14.62	Production and Processing, Processing Information	Engineering and Technology; Mechanical; Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment; Repairing and Maintaining Mechanical Equipment
		Roofers	\$ 15.17	Building and Construction; Evaluating Information to Determine Compliance with Standards	Engineering and Technology; Mechanical; Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment; Repairing and Maintaining Mechanical Equipment

*Skills data available through O*Net (www.onetcenter.org)*

For the Advanced Manufacturing cluster, as with some other occupational groups that are highly specialized, it may be necessary to fill vacancy needs by up-training those already in the group.

Analysis of Information Technology Cluster

Information technology (IT) is one of the fastest-developing and most important industries in America today. In fact, the IT field has quickly become so versatile and so vital to every industry within our economy that it can be difficult to think of it as an occupational group in its own right. One can easily see how much our economy (and our society, in general) relies on technology every day. And while nearly every industry includes a number of positions that focus solely on information technology, even those that do not almost certainly require the use of computers and technology to accomplish tasks and process information. This universal reliance upon technology, as well as the field's ever-evolving nature, ensure that the IT occupational group will be a growing source of jobs for the economy for years to come.

An occupational group that is largely characterized by constant change and by its support of every other industry will inevitably display a wide variety of skills and backgrounds within its workforce. In fact, it is equally as common to characterize the IT group by the types of jobs available as it is by the industries which are technology driven. Regardless of how one chooses to view the positions within IT, it is clear that there are a variety of positions available in a variety of industries. One common trend across all IT positions in all industries is the increasing importance of technical and professional occupations as the field continues to evolve and expand in new directions.

The Bureau of Labor Statistics' (BLS) Standard Occupational Classification (SOC) system identifies numerous job titles that fall within the information technology range of jobs. For our purposes, the job titles (and corresponding SOC codes) that we will be including in our analysis of the information technology category are as follows: Network and Computer Systems Administrators (151071), Computer Software Engineers, Systems Software (151032), Computer Systems Analysts (151051), Computer Software Engineers, Applications (151031); and Network Systems and Data Communications Analysts (151081). These particular job titles were chosen based upon their combination of relatively high projected employment growth, median salaries, and current vacancy needs.

Using survey data received from employers, we were able to determine which Knowledge Areas and Work Activities would be most beneficial to applicants looking for work in the information technology category. According to the data for this group and these positions, it is most beneficial for applicants to have knowledge in Computers and Electronics; Customer and Personal Service; Engineering and Technology; English Language; Mathematics; and Telecommunications. Also, it is beneficial for applicants to have work experience in Communication with Supervisors, Peers, or Subordinates; Getting Information; Identifying Objects, Actions, and Events; Inspecting Equipment, Structures, or Materials; Making Decisions and Solving Problems; and Updating

¹ <http://win.iwd.state.ia.us/pubs/region01/region01occproj.pdf>

and Using Relevant Knowledge.

From the sample population of 1,894 respondents, 313 respondents (16.5% of the population) were clustered into the Information Technology cluster. This group is well suited to occupations in the IT sector due to their education or work history and would need relatively less training than the population as a whole. The cluster had an average skill level of 3.58 in the critical knowledge variables, an average skill level of 3.73 in the work activity variables critical to occupations in IT, and an average level of 2.68 in all knowledge and work activity variables. A higher average skill level in the critical variables than in all variables combined means that the population within this cluster are better suited, educationally and experientially, in occupations within the IT sector than they are suited for all occupations in general. With an average occupational skill level across the knowledge critical variables of 4.17 and 4.54 in the critical work activity variables, it appears that, while the clustered population is better suited than the rest of the population to perform the occupations within Information Technology, they would still require some training.

Table 13 compares the critical skill levels of the IT clustered population with those levels required by the IT occupational cluster, with the analysis across all variables in Appendix D. Critical knowledge areas are marked with a subscript k. Within the knowledge variables, the IT clustered population falls short in the variables of Computers and Electronics, Engineering and Technology, and Telecommunications. Using the level translation table of formal education required to achieve each O*NET level developed earlier, it can be seen what needs to be done to educate the clustered population to the level which is needed by the occupations within the IT field.

The IT clustered population has, on average, a level of 3.89 in the Computers and Electronics skill variable. This

Table 13
Skills Gap for the Information Technology Cluster

Critical Skill & Knowledge Needs	Population Cluster	Average Level Needed	Gap
Telecommunications	2.02	3.94	-1.92
Computers & Electronics	3.89	5.49	-1.60
Interacting with Computers	3.29	4.76	-1.47
Identifying Objects, Actions, or Events	2.88	4.34	-1.46
Getting Information	3.03	3.96	-0.93
Engineering & Technology	3.02	3.93	-0.91
Communication with Supervisors, Peers, or Subordinates	3.88	4.50	-0.62
Updating & Using Relevant Information	4.8	5.28	-0.48
Making Decisions & Problem Solving	4.48	4.39	0.09
Mathematics	3.95	3.82	0.13
Customer Service	4.39	4.07	0.32
English Language	4.19	3.74	0.45
<i>Average Critical Variables</i>	3.65	4.35	
<i>Average all Variables</i>	2.68	2.75	
<i>Average Knowledge Variables</i>	3.58	4.17	
<i>Average Work Activity Variables</i>	3.73	4.54	

is roughly commensurate with almost an associates degree level of education in the field. The previous table shows that occupations within the IT occupational cluster need, on average, a 5.49 level in the variable, or roughly an undergraduate degree. From here the courses that would typically be given, or skills that would be taught, within the undergraduate degree curriculum can be studied, and it can be decided if there is a cost effective and efficient way to deliver some of this knowledge to the portion of the population that would most benefit. The average level of Engineering and Technology within the IT clustered population is at 3.02, just at the high school level, while the average occupation needs a level of 3.93 in the variable, about an associate's degree level.

Within the Work Activity variables, the IT clustered population falls short in the variable of Interacting with Computers. A gap analysis in the work activity variables is more subjective than that done with the knowledge variables. These tasks are harder to quantify than the knowledge variables, and commensurate time in training is given as a range. However, implementation of a strategy to train the population to meet the work activity needs of employers may be easier and more efficient for the region. The average level of Interacting with Computers within the IT clustered population is at 3.29, at least several months of training or experience, while the average occupation needs a level of 4.76, minimum of two years of training or experience.

Table 14 shows related occupations to the Information Technology occupations, median wages, skills and knowledge areas shared by the occupations, and areas in which skills or knowledge need improvement to satisfy the needs of the occupation within the target cluster. Generally, it is better to design pathways from occupations outside of the occupational cluster and with lower median wages and growth rates than the target occupation. For the IT cluster, as with some other occupational groups that are highly specialized, it may be necessary to fill vacancy needs by up-training those already in the group. For example, while Computer Operators is a high demand job, it is also an occupation from which workers can supply the demands for Network Systems and Data Communications Analysts.

**Table 14
Related Occupations to Information Technology**

Related Occupations		Median Wages	Overlapping Skills and Education	Required Areas for Improvement	
Information Technology	Emerging Occupation: Network Systems and Data Communications Analysts		\$ 31.75		
	Career Pathways	Electrical & Electronics Repairers, Commercial & Industrial Equipment	\$ 25.39	Engineering & Technology, Documenting/Recording Information	Mathematics, Customer Service, Processing Information, Interacting with Computers, Computers & Electronics
		Computer, Automated Teller, & Office Machine Repairers	\$ 17.77	Engineering & Technology, Monitoring and Controlling Processes	Telecommunications, Customer Service, Evaluating Information to Determine Compliance, Interacting with Computers
		Computer Operators	\$ 15.88	Computers & Electronics, Controlling Machines and Processes	Engineering & Technology, Telecommunications, Interacting with Computers, Processing Information
	Emerging Occupation: Computer Software Engineers		\$ 35.03		
	Career Pathways	Inspectors, Testers, Sorters, Samplers, and Weighers	\$ 15.60	Customer Service, Processing Information	Telecommunications, Engineering & Technology, Interacting with Computers, Thinking Creatively
		Bookkeeping, Accounting, and Auditing Clerks	\$ 14.60	Communications and Media; Communicating with Supervisors, Peers, or Subordinates	Telecommunications, Computers & Electronics, Thinking Creatively, Interacting with Computers
		Bus and Truck Mechanics and Diesel Engine Specialists	\$ 18.19	Customer Service, Documenting/Recording Information	Telecommunications, Computers & Electronics, Thinking Creatively, Interacting with Computers

*Skills data available through O*Net (www.onetcenter.org)*

Conclusion

When analyzing the data for education and policy decisions it is important to remember what a Skillshed analysis can do and what it cannot do. A Skillshed analysis is an important tool for analyzing the strengths and weaknesses in the current set of skills of the population, or clustered sub sets of the population, when compared to the necessary set of skills for an occupational cluster. From the analysis, a directory of critical knowledge areas or work activities that the population needs to satisfy selected occupational clusters can be developed. The level of those critical skills held by the population can also be estimated and compared with the educational or experiential needs of the occupational cluster. A Skillshed is less appropriate, however, when used to show exactly how many years of training a population needs to meet the needs of a specific occupation. A Skillshed analysis is more appropriate on the general level of showing in which areas of training or education a region's workforce is more skilled or less skilled. Referring back to the tables for each occupational group, the population is closer to meeting the required level of work activity to satisfy the target occupations than it is at meeting the required level within the knowledge areas. This is consistent with the analysis in other regional Skillsheds and supports the argument for expanding opportunities in the number of occupations that are considered apprenticeable.

The population is well-prepared to perform the occupations on a skills-basis, but needs support in developing the educational knowledge specific to the job. As many of the occupations within the three target clusters are highly specialized, it may be more effective to deliver the needed training through a job-specific program rather than a traditional approach. Another possible solution would be to develop the delivery system of required education within the region to non-traditional students. The majority of the population is working adults with little time or resources to attend traditional, daytime classes. A technology-based delivery system better suits their needs and can be delivered at a lower cost.

¹ <http://win.iwd.state.ia.us/pubs/region01/region01occproj.pdf>

Table 15 shows the critical areas for the three target occupational groups and in which areas the population may need supplemental education or training. Programs of education or skills training in the shared areas of needed training are those in which the region would benefit most. While the table shows no areas in which training is needed across more than one group there is still need for educational and experiential programs to satisfy the needs shown. Relative to other regions, the Northeast Iowa Business Network showed exceptional preparedness for the three targeted occupational groups, only needing additional education or training in few critical areas for each cluster. This table can be used with others in the report to help identify the programs and depth of instruction needed to transition the current workforce into one ready to confront the needs of knowledge-based industries and occupations.

**Table 15
Population Skills Gaps**

Critical Skill & Knowledge Needs	Advanced Manufacturing	Healthcare	Information Technology
Administration and Management	-	-	-
Assisting and Caring for Others	-	-	-
Communication with Supervisors, Peers, or Subordinates	-	-	-
Computers & Electronics	-	-	Yes
Customer Service	-	Yes	-
Design	Yes	-	-
Documenting and Recording Information	-	Yes	-
Engineering & Technology	Yes	-	Yes
English Language	-	-	-
Establishing and maintaining Interpersonal Relationships	-	-	-
Getting Information	-	-	Yes
Identifying Objects, Actions, or Events	-	-	Yes
Inspecting Equipment, Structures, or Material	-	-	-
Interacting with Computers	-	-	Yes
Making Decisions and Problem Solving	-	Yes	-
Mathematics	-	-	-
Mechanical	Yes	-	-
Medicine & Dentistry	-	-	-
Psychology	-	Yes	-
Telecommunications	-	-	Yes
Therapy & Counseling	-	Yes	-
Updating and Using relevant Knowledge	-	Yes	-

Appendix

Appendix A: O*NET Level Anchors

O*NET uses a scaling system of one to seven to designate the level of proficiency needed in a skill or knowledge area for an occupation. O*NET also provides a directory of level anchors to guide the user in interpreting the progressive difficulty of each level. By reviewing the anchors across all skills and knowledge areas we can estimate a commensurate level of education or years of experience needed to achieve a level within a specific skill or knowledge area. Below is a sample of the level anchors provided in the O*NET database.

Skill	Anchor Value	Anchor Example
Biology	1	Feed domestic animals
Computers & Electronics	1	Operate a VCR to watch a pre-recorded training tape
Mathematics	1	Add two numbers
Medicine & Dentistry	1	Use a band-aid
Public Safety & Security	1	Use a seatbelt
Thinking Creatively	1	Change the spacing on a printed report
Active Listening	2	Take a customer's order
Chemistry	2	Use a common household bug spray
Clerical	2	File letters alphabetically
Customer & Personal Service	2	Process customer dry-cleaning drop off
English Language	2	Write a thank you note
Geography	2	Know the capital of the United States
Mathematics	2	Count the amount of change to be given to a customer
Mechanical	2	Replace the filters in a furnace
Sales & Marketing	2	Sell cakes at a bake sale
Speaking	2	Greet tourists & explain tourist attractions
Therapy & Counseling	2	Put ice on a sprained ankle
Writing	2	Take a telephone message
Written Comprehension	2	Understand signs on the highway
Clerical	3	Type 30 words per minute
Computers & Electronics	3	Use a word processor
Number Facility	3	Balance a checkbook
Personnel & Human Resources	3	Interview applicants for a secretarial position
Spatial Orientation	3	Find your way through a dark room without hitting anything
Active Listening	4	Answer inquiries regarding credit references
Administration & Management	4	Monitor progress of a project to ensure timely completion
Customer & Personal Service	4	Work as a day care aide supervising 10 children
Economics & Accounting	4	Develop financial investment programs for individual clients
English Language	4	Edit a feature article in a local newspaper
Getting Information	4	Review a budget
Interacting With Computers	4	Write software for keeping track of parts in inventory
Making Decisions & Solving Problems	4	Select the location for a major department store
Mathematics	4	Analyze data to determine areas with the highest sales
Mechanical	4	Replace a valve on a steam pipe
Processing Information	4	Calculate the adjustments for insurance claims
Psychology	4	Understand the impact of alcohol on human responses
Repairing & Maintaining Electronic Equipment	4	Make repairs by removing & replacing circuit boards
Therapy & Counseling	4	Provide job counseling to the unemployed
Thinking Creatively	4	Adapt popular music for a high school marching band
Writing	4	Write a memo to staff outlining new directives
Written Comprehension	4	Understand an apartment lease

Appendix A: O*NET Level Anchors (continued)

Skill	Anchor Value	Anchor Example
Biology	5	Investigate the effects of pollution on marine plants & animals
Clerical	5	Organize a storage system for company forms
Food Production	5	Operate a commercial fishing boat
Medicine & Dentistry	5	Fill a tooth cavity
Number Facility	5	Compute the interest payment that should be generated from an investment
Sociology & Anthropology	5	Write a pamphlet about cultural differences
Transportation	5	Steer a large freighter through a busy harbor
Administration & Management	6	Manage a \$10 million company
Computers & Electronics	6	Create a program to scan computer disks for viruses
Customer & Personal Service	6	Respond to a citizen's request for assistance after a major
Economics & Accounting	6	Keep a major corporation's financial records
English Language	6	Teach a college English class
Getting Information	6	Study international tax laws
Interacting With Computers	6	Set up a new computer system for a large multinational company
Making Decisions & Solving Problems	6	Make the final decision about a company's 5-year plan
Mathematics	6	Derive a complex mathematical equation
Psychology	6	Treat a person with severe mental illness
Repairing & Maintaining Electronic Equipment	6	Use complex test equipment to calibrate electronic equipment
Therapy & Counseling	6	Counsel an abused child
Thinking Creatively	6	Create new computer software
Written Comprehension	6	Understand an instruction book on repairing missile guidance
Biology	7	Isolate & identify a new virus
Mechanical	7	Overhaul an airplane jet engine
Medicine & Dentistry	7	Perform open heart surgery
Provide Consultation & Advice to Others	7	Provide ideas for changing an organization to increase
Resolving Conflicts & Negotiating with Others	7	Negotiate a major labor-management contract
Sociology & Anthropology	7	Create a new theory about the development of civilizations
Telecommunications	7	Develop a new, world-wide telecommunications network

Appendix B: O*NET Level Translation

To estimate relevant levels of education and experience, we separated the skills into those related to formal education (knowledge areas) and those related to work tasks. The table below shows the estimate used to translate the O*NET level into a commensurate level of education or experience.

	O*NET Level	Level Translation
Knowledge	1	Less than 9th Grade
Work Related Activity	1	No previous experience
Knowledge	2	Some High School, No diploma
Work Related Activity	2	Less than a few weeks training or experience
Knowledge	3	Completed High School
Work Related Activity	3	Up to several months of training or experience
Knowledge	4	Associate level
Work Related Activity	4	At least one year of training or experience
Knowledge	5	Bachelor's level
Work Related Activity	5	Minimum of two to four years training or experience
Knowledge	6	Post Graduate level
Work Related Activity	6	At least five to ten years of training or experience
Knowledge	7	Post Graduate level plus experience
Work Related Activity	7	Greater than ten years of training or experience

Appendix C: 15 Knowledge Clusters Projected Employment

The Purdue Center for Regional Development developed the framework for the 15 Knowledge Clusters. Knowledge Clusters are based on O*NET job zones and agglomerated by similar tasks. Shown below are the occupations by projected percentage change in employment in the region¹, Iowa², and nationally³.

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Managerial, Sales, Marketing and HR Category		1.12%	1.07%
111011	Chief executives	-0.10%	-0.14%
111021	General and operations managers	0.03%	-0.01%
112011	Advertising and promotions managers	*	-0.17%
112021	Marketing managers	1.28%	1.25%
112022	Sales managers	1.67%	1.50%
112031	Public relations managers	1.20%	1.29%
113011	Administrative services managers	1.30%	1.25%
113031	Financial managers	0.90%	0.77%
113041	Compensation and benefits managers	*	0.85%
113042	Training and development managers	*	1.19%
113049	Human resources managers, all other	*	0.92%
113061	Purchasing managers	*	0.15%
113071	Transportation, storage, and distribution managers	-0.52%	-0.53%
119051	Food service managers	0.70%	0.53%
119071	Gaming managers	*	1.18%
119081	Lodging managers	0.52%	0.47%
119141	Property, real estate, and community association managers	0.88%	0.84%
131071	Employment, recruitment, and placement specialists	2.51%	2.79%
131072	Compensation, benefits, and job analysis specialists	2.49%	2.36%
131081	Logisticians	2.07%	1.96%
131111	Management analysts	1.55%	2.39%
131121	Meeting and convention planners	1.36%	1.56%
193021	Market research analysts	2.35%	2.81%
193022	Survey researchers	*	3.04%
273031	Public relations specialists	2.08%	2.40%
351011	Chefs and head cooks	*	0.02%
411012	First-line supervisors/managers of non-retail sales workers	0.58%	0.48%
413011	Advertising sales agents	0.71%	0.72%
413031	Securities, commodities, and financial services sales agents	1.83%	0.93%
419031	Sales engineers	*	0.88%
434161	Human resources assistants, except payroll and timekeeping	-0.69%	-0.57%

* Insufficient Data to Report

¹ <http://win.iwd.state.ia.us/pubs/region02/region02occproj.xls>

² <http://win.iwd.state.ia.us/pubs/statewide/stateoccproj.xls>

³ http://www.bls.gov/emp/ep_table_102.htm

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
	Skilled Production Workers: Technicians, Operators, Trades,	0.90%	0.57%
113051	Industrial production managers	0.16%	-0.77%
119021	Construction managers	1.56%	1.72%
172141	Mechanical engineers	0.99%	0.60%
173012	Electrical and electronics drafters	*	0.08%
173027	Mechanical engineering technicians	*	-0.15%
371011	First-line supervisors of housekeeping and janitorial workers	0.64%	0.51%
471011	First-line supervisors of construction trades and extraction workers	1.18%	1.54%
472031	Carpenters	1.12%	1.29%
472051	Cement masons and concrete finishers	1.42%	1.29%
472073	Operating engineers and other construction equipment operators	0.92%	1.20%
472111	Electricians	1.42%	1.19%
472152	Plumbers, pipefitters, and steamfitters	1.54%	1.53%
474021	Elevator installers and repairers	*	0.92%
491011	First-line supervisors of mechanics, installers, and repairers	0.46%	0.43%
492094	Electrical and electronics repairers, commercial and industrial equipment	1.47%	0.38%
492096	Electronic equipment installers and repairers, motor vehicles	*	0.02%
493023	Automotive service technicians and mechanics	0.59%	0.47%
493031	Bus and truck mechanics and diesel engine specialists	0.73%	0.57%
493041	Farm equipment mechanics	0.81%	0.69%
493042	Mobile heavy equipment mechanics, except engines	0.96%	0.87%
493052	Motorcycle mechanics	*	0.88%
499021	Heating, air conditioning, and refrigeration mechanics and installers	3.44%	2.81%
499031	Home appliance repairers	*	0.22%
499041	Industrial machinery mechanics	1.45%	0.73%
499042	Maintenance and repair workers, general	1.01%	1.09%
499044	Millwrights	0.94%	0.14%
499051	Electrical power-line installers and repairers	-0.45%	0.45%
511011	First-line supervisors/managers of production and operating workers	0.17%	-0.52%
512041	Structural metal fabricators and fitters	0.36%	-0.04%
514041	Machinists	0.36%	-0.46%
514111	Tool and die makers	*	-0.80%
517011	Cabinetmakers and bench carpenters	1.44%	0.91%
518012	Power distributors and dispatchers	*	-0.22%
518013	Power plant operators	0.07%	-0.16%
518021	Stationary engineers and boiler operators	*	0.52%
518092	Gas plant operators	*	-0.42%
519195	Molders, shapers, and casters, except metal and plastic	0.13%	0.28%
535031	Ship engineers	*	1.86%
536051	Transportation inspectors	*	1.84%
537021	Crane and tower operators	0.17%	-0.68%

* Insufficient Data to Report

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Healthcare Category		2.00%	2.11%
291031	Dietitians and nutritionists	0.89%	0.92%
291021	Dentists, general	1.16%	1.53%
291121	Audiologists	*	2.50%
291041	Optometrists	2.28%	2.44%
292091	Orthotists and prosthetists	*	1.55%
291011	Chiropractors	1.69%	1.95%
119111	Medical and health services managers	1.44%	1.60%
191042	Medical scientists, except epidemiologists	4.33%	4.04%
291126	Respiratory therapists	2.07%	2.09%
291071	Physician assistants	3.52%	3.90%
292054	Respiratory therapy technicians	*	-0.11%
519082	Medical appliance technicians	*	1.09%
292011	Medical and clinical laboratory technologists	0.90%	1.19%
319094	Medical transcriptionists	1.15%	1.12%
292033	Nuclear medicine technologists	*	1.63%
292051	Dietetic technicians	*	1.39%
292034	Radiologic technologists and technicians	1.64%	1.72%
292071	Medical records and health information technicians	1.81%	2.03%
292032	Diagnostic medical sonographers	*	1.83%
291051	Pharmacists	1.49%	1.70%
499062	Medical equipment repairers	2.37%	2.72%
292055	Surgical technologists	2.13%	2.53%
291124	Radiation therapists	*	2.71%
292031	Cardiovascular technologists and technicians	*	2.41%
292021	Dental hygienists	3.12%	3.61%
319092	Medical assistants	2.93%	3.39%
292056	Veterinary technologists and technicians	3.24%	3.58%
291127	Speech-language pathologists	1.26%	1.85%
211012	Educational, vocational, and school counselors	1.22%	1.40%
292061	Licensed practical and licensed vocational nurses	1.93%	2.07%
193031	Clinical, counseling, and school psychologists	0.78%	1.11%
211021	Child, family, and school social workers	0.90%	1.23%
211015	Rehabilitation counselors	1.75%	1.90%
291122	Occupational therapists	2.22%	2.56%
291111	Registered nurses	2.20%	2.22%
211022	Medical and public health social workers	2.25%	2.24%
312011	Occupational therapist assistants	*	2.98%
291123	Physical therapists	2.65%	3.03%
211013	Marriage and family therapists	*	1.45%
211023	Mental health and substance abuse social workers	2.01%	1.95%
211014	Mental health counselors	2.50%	2.40%
312021	Physical therapist assistants	2.41%	3.33%
211011	Substance abuse and behavioral disorder counselors	1.79%	2.10%

* Insufficient Data to Report

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Mathematics, Statistics, Data and Accounting		1.84%	1.37%
113021	Computer and information systems managers	1.84%	1.69%
113031	Financial managers	0.90%	0.77%
131023	Purchasing agents, except wholesale, retail, and farm products	1.67%	1.39%
132011	Accountants and auditors	2.26%	2.17%
132031	Budget analysts	*	1.51%
132051	Financial analysts	1.90%	1.98%
132061	Financial examiners	4.40%	4.12%
151021	Computer programmers	-0.35%	-0.29%
151061	Database administrators	1.84%	2.03%
152011	Actuaries	2.16%	2.14%
152021	Mathematicians	*	2.25%
152031	Operations research analysts	1.79%	2.20%
152041	Statisticians	*	1.31%
152091	Mathematical technicians	*	0.85%
193011	Economists	*	0.58%
439011	Computer operators	*	-1.86%
439111	Statistical assistants	*	0.51%

* Insufficient Data to Report

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Legal and Financial Services and Real Estate		1.28%	0.97%
131031	Claims adjusters, examiners, and investigators	1.49%	0.71%
131032	Insurance appraisers, auto damage	*	0.05%
131051	Cost estimators	2.60%	2.53%
131071	Employment, recruitment, and placement specialists	2.51%	2.79%
132021	Appraisers and assessors of real estate	0.32%	0.46%
132041	Credit analysts	2.42%	1.50%
132052	Personal financial advisors	3.76%	3.01%
132053	Insurance underwriters	0.66%	-0.41%
132071	Loan counselors	*	1.63%
132072	Loan officers	1.89%	1.01%
132081	Tax examiners, collectors, and revenue agents	*	1.30%
132082	Tax preparers	*	0.29%
231011	Lawyers	1.31%	1.30%
231021	Administrative law judges, adjudicators, and hearing officers	*	0.80%
231023	Judges, magistrate judges, and magistrates	*	-0.26%
232011	Paralegals and legal assistants	2.98%	2.81%
232091	Court reporters	*	1.83%
232092	Law clerks	*	1.39%
232093	Title examiners, abstractors, and searchers	0.97%	-0.07%
254011	Archivists	*	0.65%
254031	Library technicians	0.50%	0.88%
339021	Private detectives and investigators	*	2.20%
413021	Insurance sales agents	2.09%	1.19%
413031	Securities, commodities, and financial services sales agents	1.83%	0.93%
419021	Real estate brokers	1.08%	0.86%
433011	Bill and account collectors	1.88%	1.93%
433021	Billing and posting clerks and machine operators	1.34%	1.53%
433031	Bookkeeping, accounting, and auditing clerks	1.07%	1.03%
433051	Payroll and timekeeping clerks	-0.79%	-0.53%
433061	Procurement clerks	0.80%	0.58%
434011	Brokerage clerks	*	-0.26%
434031	Court, municipal, and license clerks	0.16%	0.82%
434041	Credit authorizers, checkers, and clerks	2.11%	0.28%
434061	Eligibility interviewers, government programs	0.15%	0.92%
434071	File clerks	-2.32%	-2.34%
434121	Library assistants, clerical	0.66%	1.11%
434131	Loan interviewers and clerks	1.17%	0.43%
436011	Executive secretaries and administrative assistants	1.22%	1.28%
436012	Legal secretaries	1.98%	1.84%

* Insufficient Data to Report

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Information Technology		2.13%	1.48%
173024	Electro-mechanical technicians	*	-0.49%
492011	Computer, automated teller, and office machine repairers	-0.57%	-0.44%
173023	Electrical and electronic engineering technicians	0.09%	-0.22%
172061	Computer hardware engineers	*	0.38%
492091	Avionics technicians	*	1.06%
274012	Broadcast technicians	*	0.18%
151041	Computer support specialists	1.43%	1.38%
274011	Audio and video equipment technicians	*	1.26%
151071	Network and computer systems administrators	1.88%	2.32%
151032	Computer software engineers, systems software	3.14%	3.04%
151051	Computer systems analysts	2.24%	2.03%
151031	Computer software engineers, applications	3.43%	3.40%
151081	Network systems and data communications analysts	5.43%	5.34%
Natural Sciences and Environmental Management		1.05%	1.63%
119121	Natural sciences managers	*	1.14%
171021	Cartographers and photogrammetrists	*	2.68%
173031	Surveying and mapping technicians	*	2.04%
191011	Animal scientists	*	1.32%
191013	Soil and plant Scientists	0.22%	1.55%
191021	Biochemists and biophysicists	*	3.74%
191022	Microbiologists	*	1.22%
191023	Zoologists and wildlife biologists	*	1.28%
191029	Biological scientists, all other	*	1.88%
191031	Conservation scientists	*	1.19%
191032	Foresters	*	1.21%
192021	Atmospheric and space scientists	*	1.47%
192041	Environmental scientists and specialists, including health	2.09%	2.79%
192042	Geoscientists, except hydrologists and geographers	*	1.75%
192043	Hydrologists	*	1.83%
194041	Geological and petroleum technicians	*	0.15%
194091	Environmental science and protection technicians, including health	1.51%	2.89%
194093	Forest and conservation technicians	0.40%	0.86%
332022	Forest fire inspectors and prevention specialists	*	0.84%
454011	Forest and conservation workers	*	0.85%

* Insufficient Data to Report

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Agribusiness and Food Technology		1.20%	0.99%
119011	Farm, ranch, and other agricultural managers	0.61%	0.59%
119012	Farmers and ranchers	-0.24%	-0.80%
131021	Purchasing agents and buyers, farm products	*	-0.11%
191012	Food scientists and technologists	1.33%	1.63%
194011	Agricultural and food science technicians	1.14%	0.88%
194021	Biological technicians	1.25%	1.76%
194031	Chemical technicians	*	-0.08%
259021	Farm and home management advisors	*	0.12%
291131	Veterinarians	2.67%	3.30%
373012	Pesticide handlers, sprayers, and applicators, vegetation	1.11%	1.77%
452011	Agricultural inspectors	*	1.28%
452021	Animal breeders	*	0.58%
518031	Water and liquid waste treatment plant and system operators	1.72%	1.98%

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Primary/Secondary and Vocational Education, Remediation and Social Services		1.47%	1.55%
119031	Education administrators, preschool and child care	1.17%	1.18%
119032	Education administrators, elementary and secondary school	0.79%	0.86%
119151	Social and community service managers	1.12%	1.38%
131073	Training and development specialists	2.59%	2.33%
194061	Social science research assistants	*	1.78%
211091	Health educators	2.56%	1.82%
211093	Social and human service assistants	1.21%	2.26%
212011	Clergy	*	1.27%
212021	Directors, religious activities and education	*	1.26%
231022	Arbitrators, mediators, and conciliators	*	1.40%
252011	Preschool teachers, except special education	1.82%	1.90%
252012	Kindergarten teachers, except special education	1.46%	1.50%
252021	Elementary school teachers, except special education	1.51%	1.58%
252022	Middle school teachers, except special and vocational	1.46%	1.53%
252031	Secondary school teachers, except special and vocational	0.82%	0.89%
252032	Vocational education teachers, secondary school	0.91%	0.96%
252041	Special education teachers, preschool, kindergarten, and elementary	1.78%	1.96%
252042	Special education teachers, middle school	1.73%	1.81%
252043	Special education teachers, secondary school	1.22%	1.33%
253011	Adult literacy, remedial education, and GED teachers	*	1.51%
259031	Instructional coordinators	1.81%	2.32%
259041	Teacher assistants	0.94%	1.03%
272022	Coaches and scouts	2.36%	2.48%
399032	Recreation workers	1.11%	1.47%
399041	Residential advisors	0.83%	0.91%
434111	Interviewers, except eligibility and loan	1.62%	1.56%

* Insufficient Data to Report

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Building, Landscape, and Construction Design		1.01%	1.50%
173013	Mechanical drafters	-0.05%	-0.11%
173011	Architectural and civil drafters	0.46%	0.91%
173022	Civil engineering technicians	1.52%	1.69%
194061	Social science research assistants	*	1.78%
193051	Urban and regional planners	*	1.90%
171012	Landscape architects	*	1.97%
171011	Architects, except landscape and naval	1.52%	1.62%
474011	Construction and building inspectors	1.03%	1.68%
173031	Surveying and mapping technicians	*	2.04%
171022	Surveyors	1.56%	1.49%
SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Engineering and Related Services		1.20%	1.39%
172072	Electronics engineers, except computer	*	0.03%
172131	Materials engineers	*	0.93%
172071	Electrical engineers	0.68%	0.17%
271021	Commercial and industrial designers	0.38%	0.90%
119041	Engineering managers	0.53%	0.62%
172041	Chemical engineers	*	-0.21%
172021	Agricultural engineers	*	1.21%
192032	Materials scientists	*	1.20%
192031	Chemists	0.82%	0.25%
172111	Health and safety engineers, except mining safety engineers and inspectors	*	1.03%
173026	Industrial engineering technicians	1.61%	0.66%
172151	Mining and geological engineers, including mining safety engineers	*	1.53%
172011	Aerospace engineers	*	1.04%
173021	Aerospace engineering and operations technicians	*	0.23%
518011	Nuclear power reactor operators	*	1.89%
172121	Marine engineers and naval architects	*	0.58%
172051	Civil engineers	2.28%	2.43%
172112	Industrial engineers	2.13%	1.42%
172031	Biomedical engineers	*	7.20%
173025	Environmental engineering technicians	*	3.01%
172081	Environmental engineers	*	3.06%

* Insufficient Data to Report

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Personal Services Occupations		1.69%	1.41%
253021	Self-enrichment education teachers	2.92%	3.21%
319011	Massage therapists	1.73%	1.89%
352013	Cooks, private household	*	0.43%
391021	First-line supervisors/managers of personal service workers	1.31%	1.54%
395011	Barbers	*	1.16%
395012	Hairdressers, hairstylists, and cosmetologists	1.15%	2.01%
395092	Manicurists and pedicurists	*	1.88%
395094	Skin care specialists	*	3.79%
396021	Tour guides and escorts	1.07%	1.17%
396022	Travel guides	*	0.17%
399011	Child care workers	1.07%	1.09%
399031	Fitness trainers and aerobics instructors	2.58%	2.94%
413041	Travel agents	*	-0.11%
499064	Watch repairers	*	-1.38%
SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Arts, Entertainment, Publishing and Broadcasting		0.99%	0.74%
131011	Agents and business managers of artists, performers, and athletes	*	2.24%
271011	Art directors	*	1.17%
271013	Fine artists, including painters, sculptors, and illustrators	*	0.90%
271014	Multi-media artists and animators	*	1.42%
271022	Fashion designers	*	0.08%
271024	Graphic designers	1.27%	1.29%
271025	Interior designers	1.52%	1.94%
271027	Set and exhibit designers	*	1.66%
272012	Producers and directors	0.71%	0.98%
272032	Choreographers	*	0.53%
272041	Music directors and composers	*	1.00%
273011	Radio and television announcers	-0.27%	-0.61%
273021	Broadcast news analysts	*	0.41%
273022	Reporters and correspondents	-0.53%	-0.76%
273041	Editors	-0.04%	-0.03%
273042	Technical writers	2.53%	1.82%
273043	Writers and authors	1.52%	1.48%
273091	Interpreters and translators	2.23%	2.22%
274013	Radio operators	*	0.90%
274014	Sound engineering technicians	*	0.63%
274021	Photographers	1.25%	1.15%
274031	Camera operators, television, video, and motion picture	*	0.92%
274032	Film and video editors	*	1.19%
439031	Desktop publishers	*	-2.25%
439081	Proofreaders and copy markers	*	-0.61%
492097	Electronic home entertainment equipment installers and	1.57%	1.08%
499063	Musical instrument repairers and tuners	*	0.01%
519071	Jewelers and precious stone and metal workers	*	0.53%
519195	Molders, shapers, and casters, except metal and plastic	0.13%	0.28%

* Insufficient Data to Report

Appendix C: 15 Knowledge Clusters Projected Employment (continued)

SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Public Safety and Domestic Security		0.86%	1.29%
131061	Emergency management specialists	*	2.17%
172111	Health and safety engineers, except mining safety engineers and inspectors	*	1.03%
194092	Forensic science technicians	*	1.96%
299011	Occupational health and safety specialists	1.98%	1.12%
299012	Occupational health and safety technicians	*	1.44%
331011	First-line supervisors/managers of correctional officers	*	0.85%
331012	First-line supervisors/managers of police and detectives	0.36%	0.81%
331021	First-line supervisors/managers of fire fighting and prevention workers	*	0.82%
332011	Fire fighters	1.36%	1.85%
332021	Fire inspectors and investigators	*	0.93%
333012	Correctional officers and jailers	0.20%	0.94%
333021	Detectives and criminal investigators	*	1.66%
333031	Fish and game wardens	*	0.83%
333051	Police and sheriff's patrol officers	0.37%	0.87%
532021	Air traffic controllers	*	1.31%
532022	Airfield operations specialists	*	1.30%
535021	Captains, mates, and pilots of water vessels	*	1.73%
536041	Traffic technicians	*	1.04%
536051	Transportation inspectors	*	1.84%
SOC	Occupation	Projected Employment Change 2008 2018 (Iowa)	Projected Employment Change 2008 2018 (National)
Postsecondary Education and Knowledge Creation		0.51%	1.67%
119033	Education administrators, postsecondary	0.17%	0.23%
152021	Mathematicians	*	2.25%
152041	Statisticians	*	1.31%
192011	Astronomers	*	1.60%
192012	Physicists	*	1.59%
192031	Chemists	0.82%	0.25%
193011	Economists	*	0.58%
193032	Industrial-organizational psychologists	*	2.63%
193041	Sociologists	*	2.19%
193091	Anthropologists and archeologists	*	2.81%
193092	Geographers	*	2.62%
193093	Historians	*	1.15%
193094	Political scientists	*	1.95%
254012	Curators	*	2.30%
254013	Museum Technicians and Conservators	*	2.56%
254021	Librarians	0.53%	0.78%

* Insufficient Data to Report

Appendix D: Current Skillshed of Workforce by Population and Selected Groups

Appendix D shows the level of skill attained by the population and each of the three clustered groups using the O*NET framework and measured by work experience and education of the workforce. The table below shows the O*NET Knowledge areas, those used to show the level and area of education. The highlighted cells are those critical to the selected occupational group. For example, biology is a critical area for the Agricultural Business & Food Technology occupational group. The table shows that those clustered into the Agricultural Business & Food Technology group have, on average, a higher level of education in biology than the general population or those clustered into the other groups. The table on the next page show the O*NET Work Activity areas, those used to show the level of experience in certain job skills.

Knowledge and Work Activity Areas	Advanced Manufacturing	Information Technology	Healthcare	Population
Administration and Mgmt	3.92	2.90	2.51	3.23
Biology	1.06	1.13	1.90	1.03
Building and Construction	2.35	2.93	0.46	1.19
Chemistry	1.82	1.84	2.23	1.51
Clerical	3.16	4.52	2.37	3.20
Communications and Media	1.92	2.23	1.76	1.94
Computers and Electronics	3.06	3.89	2.36	2.92
Customer Service	3.90	4.38	4.10	4.09
Design	2.38	3.10	0.90	1.45
Economics and Accounting	2.66	3.38	1.02	2.03
Education and Training	3.43	3.61	3.28	3.17
Engineering and Technology	2.33	3.02	1.14	1.51
English Language	3.39	4.19	3.31	3.44
Fine Arts	0.29	0.77	0.36	0.35
Food Production	0.85	1.45	0.69	0.68
Foreign Language	0.79	1.83	1.08	0.88
Geography	1.45	2.23	1.04	1.25
History	0.64	1.17	0.83	0.65
Law and Government	2.64	3.15	1.87	2.21
Mathematics	3.79	3.95	2.87	3.26
Mechanical	3.15	3.36	1.53	1.95
Medicine and Dentistry	0.97	1.24	2.36	1.21
Human Resources	3.02	3.14	1.91	2.42
Philosophy and Theology	0.93	1.10	1.91	1.19
Physics	1.56	1.78	1.04	1.04
Production and Processing	2.85	2.68	1.58	2.07
Psychology	2.59	1.96	3.46	2.60
Public Safety an Security	2.78	3.07	2.54	2.42
Sales and Marketing	2.65	3.08	1.23	2.12
Sociology and Anthropology	1.33	1.24	2.04	1.45
Telecommunications	1.40	2.02	0.98	1.28
Therapy and Counseling	1.15	1.72	2.39	1.42
Transportation	2.03	2.63	1.34	1.61

Appendix D: Current Skillshed of Regional Workforce by three clusters & as a whole (continued)

Knowledge and Work Activity Areas	Advanced Manufacturing	Information Technology	Healthcare	Population
Assisting and Caring for Others	2.81	1.87	4.19	3.15
Coaching and Developing Others	3.50	2.53	3.18	3.15
Communicating with persons outside of Organization	3.84	2.65	2.83	3.40
Communicating with persons inside organization	4.35	3.88	4.04	4.13
Controlling Machines and Processes	3.05	1.65	2.57	2.38
Coordinating Work and Activities	3.88	4.28	3.21	3.33
Developing and Building Teams	3.11	2.08	2.74	2.72
Developing Objectives and Strategies	3.40	3.48	2.50	2.78
Documenting and Recording Information	3.05	4.12	3.39	3.15
Drafting, Laying Out and Specifying Devices and Equip.	1.89	1.72	1.10	1.27
Establishing and Maintaining Interpersonal Relationships	4.64	3.10	4.47	4.54
Estimating Quantifiable Characteristics	2.92	2.08	2.41	2.49
Evaluating information to Determine Compliance	3.62	2.12	3.24	3.26
Getting Information	4.02	3.03	3.97	3.93
Guiding, Directing, and Motivating Subordinates	3.51	2.32	2.63	2.77
Handling and Moving Objects	3.83	4.21	3.92	3.47
Identifying Objects, Actions, and Events	3.85	2.88	4.18	3.81
Inspecting Equipment, Structures, or Materials	3.00	1.97	3.09	2.66
Interacting with Computers	2.86	3.30	2.30	2.78
Interpreting the Meaning of Information	2.97	2.93	2.56	2.69
Judging the Qualities of Things, Services, or People	3.89	2.62	3.22	3.35
Making Decisions and Problem Solving	4.51	4.48	3.82	3.99
Monitoring Processes, Materials, and Surroundings	3.98	3.71	4.12	3.79
Monitoring and Controlling Resources	3.73	1.46	2.19	2.73
Operating Vehicles or Equipment	2.30	1.09	1.29	1.55
Organizing, Planning, and Prioritizing Work	4.72	4.86	4.03	4.32
Performing Administrative Activities	3.05	2.49	2.27	2.79
Performing for or Working with the Public	2.90	3.80	3.40	3.19
Performing General Physical Activities	3.15	2.20	3.14	2.77
Processing Information	3.71	3.31	3.39	3.57
Provide Consultation and Advice to Others	3.39	2.01	2.53	2.83
Repairing and Maintaining Electronic Equipment	1.88	2.00	1.22	1.36
Repairing and Maintaining Mechanical Equipment	2.59	1.77	1.35	1.64
Resolving Conflicts and Negotiating with Others	3.78	2.80	3.34	3.48
Scheduling Work and Activities	3.71	3.86	2.97	3.22
Selling or Influencing Others	3.09	1.72	1.97	2.48
Staffing Organizational Units	2.58	1.17	1.58	1.88
Thinking Creatively	3.98	2.12	3.01	3.36
Training and Teaching Others	3.14	2.45	3.26	2.97
Updating and Using relevant Knowledge	4.40	4.80	3.98	4.08
<i>Average Critical Variables</i>	3.95	3.69	3.62	
<i>Average all Variables</i>	2.86	2.68	2.45	2.52
<i>Average Knowledge Variables</i>	2.19	2.57	1.83	1.90
<i>Average Work Activity Variables</i>	3.41	2.77	2.96	3.03

Appendix E: Gap Analysis of Current Skillshd and Average Level Needed by Occupational Cluster- Healthcare

Knowledge and Work Activity Areas	Healthcare Population Cluster	Healthcare Average Level Needed
Administration and Mgmt	2.51	2.81
Biology	1.90	2.89
Building and Construction	0.46	0.53
Chemistry	2.23	2.54
Clerical	2.37	3.40
Communications and Media	1.76	2.23
Computers and Electronics	2.36	3.33
Customer Service	4.10	4.89
Design	0.90	1.09
Economics and Accounting	1.02	1.57
Education and Training	3.28	4.05
Engineering and Technology	1.14	1.67
English Language	3.31	4.01
Fine Arts	0.36	0.50
Food Production	0.69	0.47
Foreign Language	1.08	1.30
Geography	1.04	1.07
History	0.83	0.87
Law and Government	1.87	2.63
Mathematics	2.87	3.14
Mechanical	1.53	1.80
Medicine and Dentistry	2.36	3.63
Human Resources	1.91	2.57
Philosophy and Theology	1.91	2.26
Physics	1.04	1.68
Production and Processing	1.58	1.67
Psychology	3.46	4.37
Public Safety an Security	2.54	2.53
Sales and Marketing	1.23	2.07
Sociology and Anthropology	2.04	2.72
Telecommunications	0.98	1.21
Therapy and Counseling	2.39	3.72
Transportation	1.34	1.31
Assisting and Caring for Others	4.19	4.88
Coaching and Developing Others	3.18	3.63
Communicating with persons outside of Organization	2.83	3.83
Communicating with persons inside organization	4.04	4.48
Controlling Machines and Processes	2.57	2.54
Coordinating Work and Activities	3.21	3.53
Developing and Building Teams	2.74	3.16
Developing Objectives and Strategies	2.50	3.41
Documenting and Recording Information	3.39	4.31
Drafting, Laying Out and Specifying Devices and Equip.	1.10	1.13
Establishing and Maintaing Interpersonal Relationships	4.47	4.93
Estimating Quantifiable Characteristics	2.41	2.73
Evaluating information to Determine Compliance	3.24	4.04
Getting Information	3.97	4.68
Guiding, Directing, and Motivating Subordinates	2.63	3.00
Handling and Moving Objects	3.92	3.39
Identifying Objects, Actions, and Events	4.18	4.82

Appendix E: Gap Analysis of Current Skillshd and Average Level Needed by Occupational Cluster- Healthcare (continued)

Knowledge and Work Activity Areas	Healthcare Population Cluster	Healthcare Average Level Needed
Inspecting Equipment, Structures, or Materials	3.09	3.01
Interacting with Computers	2.30	3.05
Interpreting the Meaning of Information	2.56	3.47
Judging the Qualities of Things, Services, or People	3.22	3.77
Making Decisions and Problem Solving	3.82	4.72
Monitoring Processes, Materials, and Surroundings	4.12	4.65
Monitoring and Controlling Resources	2.19	2.80
Operating Vehicles or Equipment	1.29	1.23
Organizing, Planning, and Prioritizing Work	4.03	4.63
Performing Administrative Activities	2.27	3.13
Performing for or Working with the Public	3.40	4.22
Performing General Physical Activities	3.14	2.82
Processing Information	3.39	4.29
Provide Consultation and Advice to Others	2.53	3.51
Repairing and Maintaining Electronic Equipment	1.22	1.41
Repairing and Maintaining Mechanical Equipment	1.35	1.44
Resolving Conflicts and Negotiating with Others	3.34	3.84
Scheduling Work and Activities	2.97	3.56
Selling or Influencing Others	1.97	2.63
Staffing Organizational Units	1.58	2.07
Thinking Creatively	3.01	3.84
Training and Teaching Others	3.26	3.74
Updating and Using relevant Knowledge	3.98	5.05
<i>Average Critical Variables</i>	3.62	4.47
<i>Average all Variables</i>	2.45	2.96
<i>Average Knowledge Variables</i>	1.83	2.32
<i>Average Work Activity Variables</i>	2.96	3.48

Appendix E: Gap Analysis of Current Skillshed and Average Level Needed by Occupational Cluster- Information Technology

Knowledge and Work Activity Areas	Information Technology Population Cluster	Information Technology Average Level Needed
Administration and Mgmt	2.90	3.33
Biology	1.13	0.36
Building and Construction	2.93	1.08
Chemistry	1.84	1.14
Clerical	4.52	3.06
Communications and Media	2.23	2.90
Computers and Electronics	3.89	5.41
Customer Service	4.38	4.10
Design	3.10	3.16
Economics and Accounting	3.38	1.31
Education and Training	3.61	3.72
Engineering and Technology	3.02	3.87
English Language	4.19	3.71
Fine Arts	0.77	0.45
Food Production	1.45	0.06
Foreign Language	1.83	0.58
Geography	2.23	1.34
History	1.17	0.42
Law and Government	3.15	1.85
Mathematics	3.95	3.78
Mechanical	3.36	3.16
Medicine and Dentistry	1.24	0.48
Human Resources	3.14	1.55
Philosophy and Theology	1.10	0.65
Physics	1.78	2.01
Production and Processing	2.68	2.49
Psychology	1.96	1.68
Public Safety an Security	3.07	2.35
Sales and Marketing	3.08	1.63
Sociology and Anthropology	1.24	0.86
Telecommunications	2.02	3.88
Therapy and Counseling	1.72	0.56
Transportation	2.63	1.47
Assisting and Caring for Others	1.87	2.27
Coaching and Developing Others	2.53	2.90
Communicating with persons outside of Organization	2.65	3.24
Communicating with persons inside organization	3.88	4.43
Controlling Machines and Processes	1.65	3.31
Coordinating Work and Activities	4.28	3.09
Developing and Building Teams	2.08	2.43
Developing Objectives and Strategies	3.48	2.98
Documenting and Recording Information	4.12	3.63
Drafting, Laying Out and Specifying Devices and Equip.	1.72	2.60
Establishing and Maintaing Interpersonal Relationships	3.10	4.53
Estimating Quantifiable Characteristics	2.08	3.05
Evaluating information to Determine Compliance	2.12	3.46
Getting Information	3.03	3.93
Guiding, Directing, and Motivating Subordinates	2.32	2.25
Handling and Moving Objects	4.21	3.69

Appendix E: Gap Analysis of Current Skillshd and Average Level Needed by Occupational Cluster- Information Technology (continued)

Knowledge and Work Activity Areas	Information Technology Population Cluster	Information Technology Average Level Needed
Identifying Objects, Actions, and Events	2.88	4.28
Inspecting Equipment, Structures, or Materials	1.97	3.42
Interacting with Computers	3.30	4.61
Interpreting the Meaning of Information	2.93	3.28
Judging the Qualities of Things, Services, or People	2.62	3.35
Making Decisions and Problem Solving	4.48	4.28
Monitoring Processes, Materials, and Surroundings	3.71	4.33
Monitoring and Controlling Resources	1.46	2.65
Operating Vehicles or Equipment	1.09	1.51
Organizing, Planning, and Prioritizing Work	4.86	4.57
Performing Administrative Activities	2.49	2.38
Performing for or Working with the Public	3.80	2.21
Performing General Physical Activities	2.20	2.96
Processing Information	3.31	4.14
Provide Consultation and Advice to Others	2.01	3.48
Repairing and Maintaining Electronic Equipment	2.00	4.27
Repairing and Maintaining Mechanical Equipment	1.77	2.69
Resolving Conflicts and Negotiating with Others	2.80	2.73
Scheduling Work and Activities	3.86	3.55
Selling or Influencing Others	1.72	1.96
Staffing Organizational Units	1.17	1.28
Thinking Creatively	2.12	4.45
Training and Teaching Others	2.45	3.26
Updating and Using relevant Knowledge	4.80	5.20
<i>Average Critical Variables</i>	3.65	4.29
<i>Average all Variables</i>	2.68	2.75
<i>Average Knowledge Variables</i>	2.57	2.07
<i>Average Work Activity Variables</i>	2.77	3.32

Appendix E: Gap Analysis of Current Skillshd and Average Level Needed by Occupational Cluster- Advanced Manufacturing

Knowledge and Work Activity Areas	Advanced Manufacturing Population Cluster	Advanced Manufacturing Level Needed
Administration and Mgmt	3.92	3.46
Biology	1.06	0.62
Building and Construction	2.35	2.88
Chemistry	1.82	2.43
Clerical	3.16	2.24
Communications and Media	1.92	1.46
Computers and Electronics	3.06	2.97
Customer Service	3.90	3.20
Design	2.38	3.41
Economics and Accounting	2.66	1.30
Education and Training	3.43	3.13
Engineering and Technology	2.33	3.55
English Language	3.39	2.94
Fine Arts	0.29	0.22
Food Production	0.85	0.39
Foreign Language	0.79	0.60
Geography	1.45	1.08
History	0.64	0.39
Law and Government	2.64	1.85
Mathematics	3.79	3.66
Mechanical	3.15	4.82
Medicine and Dentistry	0.97	0.70
Human Resources	3.02	1.92
Philosophy and Theology	0.93	0.53
Physics	1.56	2.59
Production and Processing	2.85	2.88
Psychology	2.59	1.84
Public Safety an Security	2.78	2.88
Sales and Marketing	2.65	1.55
Sociology and Anthropology	1.33	0.68
Telecommunications	1.40	1.48
Therapy and Counseling	1.15	0.73
Transportation	2.03	2.16
Assisting and Caring for Others	2.81	2.46
Coaching and Developing Others	3.50	2.97
Communicating with persons outside of Organization	3.84	2.77
Communicating with persons inside organization	4.35	4.00
Controlling Machines and Processes	3.05	4.22
Coordinating Work and Activities	3.88	3.23
Developing and Building Teams	3.11	2.47
Developing Objectives and Strategies	3.40	2.44
Documenting and Recording Information	3.05	2.92
Drafting, Laying Out and Specifying Devices and Equip.	1.89	2.77
Establishing and Maintaing Interpersonal Relationships	4.64	4.01
Estimating Quantifiable Characteristics	2.92	2.80
Evaluating information to Determine Compliance	3.62	3.26
Getting Information	4.02	3.50
Guiding, Directing, and Motivating Subordinates	3.51	2.71
Handling and Moving Objects	3.83	4.94

Appendix E: Gap Analysis of Current Skillshd and Average Level Needed by Occupational Cluster- Advanced Manufacturing (continued)

Knowledge and Work Activity Areas	Advanced Manufacturing Population Cluster	Advanced Manufacturing Level Needed
Identifying Objects, Actions, and Events	3.85	3.53
Inspecting Equipment, Structures, or Materials	3.00	3.68
Interacting with Computers	2.86	2.58
Interpreting the Meaning of Information	2.97	2.69
Judging the Qualities of Things, Services, or People	3.89	3.21
Making Decisions and Problem Solving	4.51	4.06
Monitoring Processes, Materials, and Surroundings	3.98	4.07
Monitoring and Controlling Resources	3.73	2.43
Operating Vehicles or Equipment	2.30	2.97
Organizing, Planning, and Prioritizing Work	4.72	3.94
Performing Administrative Activities	3.05	2.15
Performing for or Working with the Public	2.90	2.17
Performing General Physical Activities	3.15	4.14
Processing Information	3.71	3.31
Provide Consultation and Advice to Others	3.39	2.72
Repairing and Maintaining Electronic Equipment	1.88	3.04
Repairing and Maintaining Mechanical Equipment	2.59	3.80
Resolving Conflicts and Negotiating with Others	3.78	2.86
Scheduling Work and Activities	3.71	3.05
Selling or Influencing Others	3.09	1.94
Staffing Organizational Units	2.58	1.49
Thinking Creatively	3.98	3.49
Training and Teaching Others	3.14	2.94
Updating and Using relevant Knowledge	4.40	4.31
<i>Average Critical Variables</i>	3.52	3.66
<i>Average all Variables</i>	2.86	2.64
<i>Average Knowledge Variables</i>	2.19	2.02
<i>Average Work Activity Variables</i>	3.41	3.15

Appendix F: Knowledge and Work Activity Definitions

- Administration and Management:** Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
- Analyzing Data or Information:** Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.
- Assisting and Caring for Others:** Providing personal assistance, medical attention, emotional support, or other personal care to others such as coworkers, customers, or patients.
- Biology:** Knowledge of plant and animal organisms, their tissues, cells, functions, interdependencies, and interactions with each other and the environment.
- Building and Construction:** Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.
- Chemistry:** Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal.
- Clerical:** Knowledge of administrative and clerical procedures and systems such as word processing, managing files and records, stenography and transcription, designing forms, and other office procedures and terminology.
- Coaching and Developing Others:** Identifying the developmental needs of others and coaching, mentoring, or otherwise helping others to improve their knowledge or skills.
- Communicating with Persons Outside Organization:** Communicating with people outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged in person, in writing, or by telephone or e-mail.
- Communicating with Supervisors, Peers, or Subordinates:** Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.
- Communications and Media:** Knowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media.
- Computers and Electronics:** Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- Controlling Machines and Processes:** Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).
- Coordinating the Work and Activities of Others:** Getting members of a group to work together to accomplish tasks.
- Customer and Personal Service:** Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.
- Design:** Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- Developing and Building Teams:** Encouraging and building mutual trust, respect, and cooperation among team members.
- Developing Objectives and Strategies:** Establishing long-range objectives and specifying the strategies and actions to achieve them.
- Documenting/Recording Information:** Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.

Appendix F: Knowledge and Work Activity Definitions (continued)

- Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment:** Providing documentation, detailed instructions, drawings, or specifications to tell others about how devices, parts, equipment, or structures are to be fabricated, constructed, assembled, modified, maintained, or used.
- Economics and Accounting:** Knowledge of economic and accounting principles and practices, the financial markets, banking and the analysis and reporting of financial data.
- Education and Training:** Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.
- Engineering and Technology:** Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- English Language:** Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- Establishing and Maintaining Interpersonal Relationships:** Developing constructive and cooperative working relationships with others, and maintaining them over time.
- Estimating the Quantifiable Characteristics of Products, Events, or Information:** Estimating sizes, distances, and quantities; or determining time, costs, resources, or materials needed to perform a work activity.
- Evaluating Information to Determine Compliance with Standards:** Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards.
- Fine Arts:** Knowledge of the theory and techniques required to compose, produce, and perform works of music, dance, visual arts, drama, and sculpture.
- Food Production:** Knowledge of techniques and equipment for planting, growing, and harvesting food products (both plant and animal) for consumption, including storage/handling techniques.
- Foreign Language:** Knowledge of the structure and content of a foreign (non-English) language including the meaning and spelling of words, rules of composition and grammar, and pronunciation.
- Geography:** Knowledge of principles and methods for describing the features of land, sea, and air masses, including their physical characteristics, locations, interrelationships, and distribution of plant, animal, and human life.
- Getting Information:** Observing, receiving, and otherwise obtaining information from all relevant sources.
- Guiding, Directing, and Motivating Subordinates:** Providing guidance and direction to subordinates, including setting performance standards and monitoring performance.
- Handling and Moving Objects:** Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.
- History and Archeology:** Knowledge of historical events and their causes, indicators, and effects on civilizations and cultures.
- Identify and Evaluating Job-Relevant Information:** How is information interpreted to perform this job?
- Identifying Objects, Actions, and Events:** Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.
- Inspecting Equipment, Structures, or Material:** Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.
- Interacting With Computers:** Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.
- Interpreting the Meaning of Information for Others:** Translating or explaining what information means and how it can be used.

Appendix F: Knowledge and Work Activity Definitions (continued)

Judging the Qualities of Things, Services, or People: Assessing the value, importance, or quality of things or people.

Law and Government: Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process.

Making Decisions and Solving Problems: Analyzing information and evaluating results to choose the best solution and solve problems.

Mathematics: Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

Mechanical: Knowledge of machines and tools, including their designs, uses, repair, and maintenance.

Medicine and Dentistry: Knowledge of the information and techniques needed to diagnose and treat human injuries, diseases, and deformities. This includes symptoms, treatment alternatives, drug properties and interactions, and preventive health-care measures.

Monitor Processes, Materials, or Surroundings: Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.

Operating Vehicles, Mechanized Devices, or Equipment: Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or water craft.

Organizing, Planning, and Prioritizing Work: Developing specific goals and plans to prioritize, organize, and accomplish your work.

Performing for or Working Directly with the Public: Performing for people or dealing directly with the public. This includes serving customers in restaurants and stores, and receiving clients or guests.

Performing General Physical Activities: Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials.

Personnel and Human Resources: Knowledge of principles and procedures for personnel recruitment, selection, training, compensation and benefits, labor relations and negotiation, and personnel information systems.

Philosophy and Theology: Knowledge of different philosophical systems and religions. This includes their basic principles, values, ethics, ways of thinking, customs, practices, and their impact on human culture.

Physics: Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes.

Processing Information: Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data.

Production and Processing: Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.

Provide Consultation and Advice to Others: Providing guidance and expert advice to management or other groups on technical, systems-, or process-related topics.

Performing Administrative Activities: Performing day-to-day administrative tasks such as maintaining information files and processing paperwork.

Psychology: Knowledge of human behavior and performance; individual differences in ability, personality, and interests; learning and motivation; psychological research methods; and the assessment and treatment of behavioral and affective disorders.

Public Safety and Security: Knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.

Appendix F: Knowledge and Work Activity Definitions (continued)

Repairing and Maintaining Electronic Equipment: Servicing, repairing, calibrating, regulating, fine-tuning, or testing machines, devices, and equipment that operate primarily on the basis of electrical or electronic (not mechanical) principles.

Repairing and Maintaining Mechanical Equipment: Servicing, repairing, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.

Resolving Conflicts and Negotiating with Others: Handling complaints, settling disputes, and resolving grievances and conflicts, or otherwise negotiating with others.

Sales and Marketing: Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.

Scheduling Work and Activities: Scheduling events, programs, and activities, as well as the work of others.

Selling or Influencing Others: Convincing others to buy merchandise/goods or to otherwise change their minds or actions.

Sociology and Anthropology: Knowledge of group behavior and dynamics, societal trends and influences, human migrations, ethnicity, cultures and their history and origins.

Telecommunications: Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems.

Therapy and Counseling: Knowledge of principles, methods, and procedures for diagnosis, treatment, and rehabilitation of physical and mental dysfunctions, and for career counseling and guidance.

Thinking Creatively: Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions.

Training and Teaching Others: Identifying the educational needs of others, developing formal educational or training programs or classes, and teaching or instructing others.

Transportation: Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including the relative costs and benefits.

Updating and Using Relevant Knowledge: Keeping up-to-date technically and applying new knowledge to your job.

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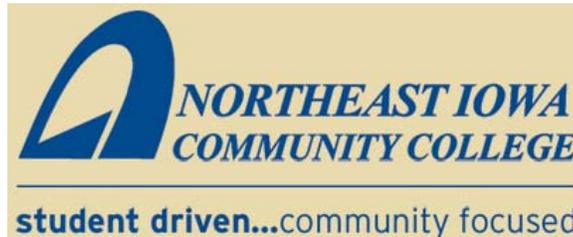
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Northeast Iowa
BUSINESS NETWORK

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