

Industry Cluster Analysis: Inspiring a Common Strategy for Community Development

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INTRODUCTION

Workforce and economic development professionals across the country and around the world are increasingly using industry cluster models to identify, validate and support local and regional industry groupings that have demonstrated or show promise of competitive advantage. Michael Porter, author of *The Competitive Advantage of Nations* (1990) and Harvard Business School professor leading the Institute for Strategy and Competitiveness, popularized the use of the cluster methodology for regional analysis. By turning the focus of public policy and economic development toward factors that increase the ability of a nation or a region to remain competitive, Porter (1990) identifies the Diamond of Advantage, four key determinants of industry competitiveness: factor conditions; home demand conditions; related and supporting industries; and industry strategy, structure and competitiveness. The competitiveness of a nation or region is based on the capacity of industries to become embedded in a deep network, which supports geographic concentrations of companies, institutions, customers and complementarities.

A significant element of the deep network of competitiveness is the creation and advancement of industry clusters. Industry clusters are formed when competitive advantages entice the growth, relocation or development of similar industries into a locale. In turn, industry clusters strengthen competitiveness by increasing productivity, stimulating innovative new partnerships, even among competitors, and presenting opportunities for entrepreneurial activity (Porter, 1998). The growing interest in and the mounting evidence of the benefits of cluster analysis have strengthened the potential effects on workforce and economic policy.

DEFINING THE CONCEPT OF INDUSTRY CLUSTER

For the purposes of this analysis, an industry cluster is defined loosely as a geographic grouping of similar industries that demonstrate an advantage. In examining the definition of an industry cluster, it is imperative that a clear distinction be made between an *industry*, an *industry sector* and an *industry cluster*.

An **industry** is the most specific component representing “a group of establishments that produce similar products or provide similar services” (Bureau of Labor Statistics, 2003). A given industry, or even a particular establishment in that industry, might have employees in dozens of occupations. Numerous structures exist to classify industries, the most universal being the Standard Industrial Classification (SIC) system. Currently, the federal Bureau of Labor Statistics is immersed in a four-year conversion from the more than 70-year old SIC system created during the height of the industrial age, to the North American Industrial Classification System (NAICS). Based on a consistent principle that businesses that do similar things in similar ways are grouped together, NAICS identifies hundreds of new, emerging and advanced technology industries by reorganizing industries into more meaningful sectors.

An **industry sector** is a group of firms sharing some commonality, which may be the product, the inputs or the skill sets of employees (Bergman & Feser, 1999). While the SIC system groups industries into ten major classifications, the NAICS combines unique industries into twenty broad industry sectors (i.e. manufacturing; professional, scientific and technical services; healthcare and social assistance). Sectoral initiatives have become prevailing strategies for workforce development, particularly when focused on improving job opportunities and economic prospects for low-income individuals within a specific sector. While an industry sector, in

some cases, may be synonymous with an industry cluster, an authentic industry cluster is much broader than one sector. Rural areas often face this dilemma when one sector or even one establishment dominates employment. The challenge in rural areas is to move from traditional sector to cluster analysis, which requires considerable effort (i.e. research and industry engagement) but is arguably essential to successful rural economic development.

From the most simplistic view, **industry clusters** are “geographical concentrations of industries that gain performance advantages through co-location” (Doeringer & Terkla 1995, p. 225). Gibbs and Bernat (1997) further clarify the definition by identifying shared input needs and inter-relationships with suppliers and buyers. Rosenfeld (1997) enlarges the connections to those companies that also provide complementary services, including consultants, education and training providers, financial institutions, professional associations and government agencies. From the industry perspective, Dr. Robert Breault, a recognized photonics cluster expert and co-chairman of the Arizona Optics Industry Association (AOIA), requires a cluster to “create quality jobs, export goods and services, and unite the public sectors of economic development, legislatures at all levels, universities, community colleges, the K-12 educational community, workforce development, support foundations, and all community economic stakeholders (The International Society for Optical Engineering, 2000, n.p.).

Within these definitions, three universal themes arise:

- 1) geographic limitation;
- 2) broad definition of industry; and
- 3) competitive advantage.

The type of industry cluster being developed or identified determines the geographic limitations. Initially, Porter applied his cluster principles to national and international clusters (i.e. Norwegian maritime cluster) but soon realized the relevance for

regional and state-based clusters (e.g. California wine cluster and the Houston oil and gas cluster). Geographic span of a cluster is affected by the ability to share information, resources and knowledge. Underlying social perceptions, cultural barriers and partiality may also influence or limit the size of a cluster (Gibbs & Bernat, 1997). Rosenfeld (2002) argues that geography is determined by “the distance and time that people are willing to travel for employment and that employees and owners of companies consider reasonable for meeting and networking” (p. 12). While the advancement of information technology may contradict the influence of geography, Anderson (1994) argues that just-in-time processes, the need for face-to-face interactions and visibility of regional economies highlight the importance of geography to clustering. The geographic radius of a cluster will be determined by the existence of population centers and the specific needs of the cluster. For example, as industry prospects explore opportunities for relocation or expansion, rural areas are heavily scrutinized for the presence of deep networks that will support the presence of the industry. These networks may include transportation routes that promote timely receipt of supplies and distribution of goods or availability of a competent workforce within a 30 to 75-mile radius.

Unlike an industry sector, a true industry cluster looks beyond the production of a good or service to the entire value chain. Clusters are industries that are connected by the flow of goods and services, which is stronger than the flow linking them to the rest of the economy. Anderson (1994) stresses the importance of relationships within a cluster by identifying three cluster categories:

- 1) *Buyer-Seller Relationships* concentrate on the vertical interactions between the core production processes and the inputs and distribution of the goods or services;
- 2) *Competitor and Collaborator Relationships* exist because “competitors frequently share information (often

unintentionally) about product and process information and may, in fact, formally collaborate to develop such innovations in precompetitive or strategic alliance” (Anderson, 1994, Calculate Employment Concentrations section, para. 6); and

- 3) *Shared-Resource Relationships* identify horizontal relations stemming from shared technology, labor force or information, even among companies that may produce unrelated goods or services.

Support industries (e.g. government, professional services and training resources), which may not show a competitive advantage as stand-alone establishments, are included in clusters because the availability of interdisciplinary services enhances the productivity of the production core. Additionally, the availability or lack of these support industries can significantly influence the expansion or retention of an industry cluster. During business attraction activities, potential companies within a cluster will closely examine the quality of the region’s educational system and the level of business-friendliness exhibited by governmental policy.

Industry clusters may initially develop informally, but clusters grow because member industries perceive or receive some type of benefit from the cluster. Some commonly cited benefits include research and entrepreneurial development (Porter, 1990), economies of scale (Doeringer & Terkla, 1995) and development of specialized social infrastructure (Rosenfeld, 1997). It could be argued that cluster development leads to these benefits that in turn lead to increased cluster growth. Further, it could be argued that industry clusters also sustain and grow, in part as a result of proactive public policies that create favorable economic environments that support the establishment of these related businesses.

DEFINING THE CLUSTER ANALYSIS PROCESS

It is important to stress that the process of identifying, analyzing and supporting industry clusters requires a considerable commitment of time, resources and collaboration among regional and local stakeholders. Just as it takes years for a region to develop a competitive economy of interrelated industries, the process of developing a broad and comprehensive understanding of industry clusters is a lengthy one that may never be complete. From a workforce and economic development perspective, the investment in time and resources is justified because the process can distinguish a region's competitive industries that introduce new wealth and generate high paying employment opportunities.

Prior to the execution of this initiative, the identification of key industries was based on hunches of what was or hopes of what was desired. Industry and sector data existed, but gut instincts and unconfirmed guesswork drove workforce and economic development investment. Although the cluster analysis that follows may substantiate hunches, the region has much more information than has ever been available before. The process of identifying, analyzing and supporting industry clusters is on going. Continuing to "mine" new information will expand the scope of the initiative, but the resultant products will assist the region in achieving almost immediate outcomes.

The process as described below provides an example of the initial steps taken by the Central Pennsylvania Workforce Investment Board (WIB) to identify industry clusters. The process is not meant to be viewed as either linear or conclusive. Although this initiative may appear to be in its early stages, the process has generated substantial information that has already created opportunities for targeted investment and workforce and economic development strategy integration. In many ways, this first step is the most significant because the outcome allows for statistical validation of

existing assumptions and opens the door for strategy-driven, industry-focused public policy.

Cluster analysis is a tool used to identify those areas of the local economy in which comparative advantage(s) exists. An industry cluster is considered to have a comparative advantage if the output, productivity and growth of a cluster are high relative to other regions. A number of quantitative tools (i.e. input-output models, cluster dependency analysis and network analysis) may be applied to conduct general or restricted cluster analysis (Bergman & Feser, 1999). While quantitative analysis implies competitive advantage, qualitative analysis (i.e. expert opinion, surveys and industry research) addresses whether relationships really exist between the individual firms and accounts for other factors beyond the product-market relationships, such as industry collaboration and information flow (Doeringer & Terkla, 1995).

The Central Pennsylvania Workforce Investment Board (WIB) utilized ES202 data for all two, three and four-digit SIC codes for the period 1995-2000, which was provided by the Pennsylvania Department of Labor and Industry's Center for Workforce and Analysis (CWIA).¹ The data for all 67 of the Commonwealth's counties were provided to all 22 WIBs through the Regional Data Analysis Tool (RDAT), an Access database that allows for queries on any combination of industries and can be customized for a specific geographic locale, from a single county to multi-county region to statewide.

¹ ES202 is generated through the Commonwealth of Pennsylvania's Unemployment Compensation Insurance Reporting. This information reports Non Agriculture Wage (NAWS) and Salary Data for the majority of Pennsylvania's workforce. It is important to note, however, that ES202 is only inclusive of those employment positions which require payment of unemployment compensation insurance and therefore does not include in its count sole proprietors (which could range from small business owners to farm owners), uniform military personnel, and other government and private sector based employment.

The statistical methodology driving the database is based on the framework for “Understanding Your Industries” developed by Lee Munnich at the Hubert H. Humphrey Institute for Public Affairs at the University of Minnesota. The framework guides users through the application of several analytical tools to help identify a region’s key industries and suggest appropriate strategies to grow or retain these industries. The following list provides explanation on the key components of the cluster analysis framework.

Local Employment Analysis

The first step is to identify the impact that a specified industry cluster has on the local economy by calculating the percentage of the total locale’s workforce employed in the specified industry cluster and analyzing the growth or decline of the cluster’s employment over a time period. It is important to note that high concentrations of employment do not specifically correlate into competitive advantages.

Location Quotient

The statistic driving cluster analysis is the location quotient (LQ), a measure of an industry’s concentration in a locale relative to the nation or state. Use of the LQ assumes that uniform local consumption patterns and labor productivity across the nation or state (Munnich, 1999). The calculation results in a ratio that if equal to one means that the industry share of local employment is equal to the industry share of national employment. An LQ less than one may imply that a locale is not producing enough of the good or service requiring those goods and services to be imported from other areas (Munnich, 1999). An LQ greater than one suggests that the supply of goods or services is greater than the local demand. The industry has the capacity to generate additional income for the locale by exporting surplus goods or services. The LQ allows analysts to distinguish between non-basic, solely dependent on local conditions, and basic, influenced by non-local conditions, industry (Klosterman, 1990).

Shift Share Analysis

Upon completion, shift-share analysis will delineate the number of jobs attributable to national economic growth, the number of jobs created or not created as a result of the region’s industry mix and the growth captured due to the competitive advantages of the locale. The sum of these three components equals the actual change in total cluster employment within a region over a prescribed time period.

Payroll

In addition to analyzing the strength of an industry cluster’s employment, it is crucial to evaluate, the “economic prosperity factor,” by examining the average payroll per employee. A highly competitive LQ does not necessarily equate to a high wage industry (San Diego Association of Governments, p. 7). One tool for measuring an industry or industry cluster’s contribution to economic prosperity is to compare average annual earnings to an area’s self-sufficiency wages. The Pennsylvania Family Economic Self-Sufficiency Project (Pearce, 2001) measured the income needed for a family of a given composition in a given place to adequately meet its basic needs without public or private assistance. The data is available for all sixty-seven of Pennsylvania’s counties and metropolitan statistical areas. The annual self-sufficiency income establishes a minimum threshold, without accounting for a family’s ability to save, purchase housing or engage in recreational activity.

While these analytical tools quantitatively identify key industries and clusters, the numbers must be validated with qualitative analysis. For example, while a competitive industry cluster may not represent the majority of the region’s employment, the cluster may fuel the rest of the economy because of its strength and interrelationships with other industries. In addition, an LQ significantly larger than one does not necessarily equate with competitive advantage. Because LQs are calculated based on employment, a high LQ may suggest that

the local industry is relying on greater manpower and has not implemented possible automation and process upgrades, which may negatively affect productivity. Anderson (1994) also argues that emerging clusters, “with a low current concentration...have the potential to become significant wealth generators in the future” (Calculate Employment Concentrations section, para. 6), may be overlooked by statistical analysis and only identified qualitatively.

DEFINING THE INDUSTRY CLUSTER METHODOLOGY

The Central Pennsylvania WIB is using the “Understanding Your Industries” framework and the statewide RDATA to complete regional industry cluster analysis. The available data allowed for analysis from 1995 to 2000. For this report, the CPWDC conducted analysis for a portion of Central Pennsylvania, which is defined as the eleven counties of Centre, Clinton, Columbia, Lycoming, Juniata, Mifflin, Montour, Northumberland, Perry, Snyder and Union.

It is important to note that this geographic area was selected to correspond with the research components of this report. While this geographic area may be useful for workforce and economic development program delivery, economic regions are not nor should not be constrained by strict boundaries. In a rural area it is imperative that an economic region be defined broadly to include an entire industry cluster. Unfortunately, this model is limited in its ability to produce metropolitan statistical area or municipality level data, which would enhance the ability to analyze clusters in relation to labor markets. However, the flexibility of the model does allow for expansion and contraction of the geographic area along county lines. Further investigation and input from industry must occur to fully understand the position of the region in respect to internal and satellite clusters (Anderson, 1994).

The Central Pennsylvania WIB has approached industry cluster analysis as an ongoing initiative as opposed to a report or study. Cluster analysis is a fluid science that must be constantly evaluated against quantitative benchmarks and revised to reflect expected or unanticipated economic factors. While the work of consultants and research will remain a viable and beneficial component of regional economic development, the Central Pennsylvania WIB is committed to using cluster analysis as a guide for directing the use of limited funds rather than producing volumes of data that substantiate the perception of being “studied to death.” As the Findings section will demonstrate, the Central Pennsylvania WIB aims to supply concise information that can be delivered and communicated as an ongoing “index” of the region’s key industry clusters.

Clearly, the data and analysis used to define this initiative and the various indices of competitiveness are important to the validity of the process. However, the ultimate goal of the Central Pennsylvania WIB is to generate information that can be useful in application, primarily to drive workforce development investment, target business retention efforts and align regional resources in support of those industries that will generate wealth for the regional economy. In order for the industry cluster initiative to have long-term impacts, it cannot be viewed as a single “point in time” initiative; but rather an ongoing assessment and reassessment of those industry clusters that comprise the foundation of the economy.

The analysis follows a four-phased methodology: research and analysis, consensus building, validation and application.

Research and Analysis

In the research and analysis phase, the Central Pennsylvania WIB began by examining the employment, payroll, location quotient and shift share data for all three and four-digit SICs for the

eleven-county area. Industries were filtered into four major categories:

- 1) *Key Industries* – significant industries based on number of employees with positive employment, LQ and local competitiveness over the time period;
- 2) *Potential Growth Industries* – smaller industries based on employment size that exhibited strong employment growth and LQ increases equal to or greater than 50% over the time period;
- 3) *Dormant Industries* – those significant employers that experienced an employment decline during the time period but showed positive LQ changes; and
- 4) *Declining Industries* – those industries that showed significant employment and LQ decreases over the time period.

Industry clusters were initially centered around key industries and industry sectors. The purpose of this phase was to group like industries based on statistical evidence and common regional industry knowledge to build clusters (Anderson, 1994). As the process evolves, the entire value chain must be included in the cluster definition. Based on the premise that the interaction between and resources available to all industries within a cluster affects competitive advantage, an industry cluster includes industries from each of the four major categories described above. During the initial identification phase, eight clusters were created.

Consensus Building

In the consensus building phase, information on the eight identified clusters was shared with members of the Region Partnership, a network of regionally based economic development, workforce development, education, business association organizations and representatives of local elected officials and the private sector. Three clusters were preserved, but the remaining five were combined into one. The Diversified Manufacturing Cluster includes all types of manufacturing (with the exception of wood products manufacturing, which is part of a unique cluster) because while manufacturing is prevalent across the eleven-county area, the type of product is not consistent enough to constitute separate clusters (e.g. primary/fabricated metals, food processing, industrial machinery). While manufacturing niches exist at sub-regional or county levels, diversified manufacturing

accounts for the similarity in processes and skill sets across all types of manufacturing establishments.

The consensus building stage was a priority component of this process. If it is assumed that public policy affects the economic development environment and supports the development of industry clusters, then a broad-based regional understanding and agreement on both the process and the outcomes of cluster analysis is crucial to the development of these favorable policies. Because ownership of identified industry clusters must be broader than the WIB, consensus building with all major regional stakeholders involved in the development and support of the regional economy was the means by which macro-commitment was achieved. While the consensus stage required negotiation and resulted in positive debate with outcomes that differed slightly from the WIB's initial analysis, the broad commitment objective was achieved.

Based on the consensus-building phase, the four regional industry clusters currently under analysis for the eleven-county region are Diversified Manufacturing, Lumber and Wood Products, Healthcare and Education.

Validation

The Central Pennsylvania WIB is currently involved in the validation process. Engaging local economic development agencies, industry representatives and other interested parties in cluster analysis discussions will assist the Central Pennsylvania WIB in ensuring data accuracy and directing future applications of the analysis. In order to generate buy-in from local economic development agencies, the outcomes must have local relevance. During the Central Pennsylvania WIB's first round of data sharing with these stakeholders, the focus has been on how each county or sub-regional area relates to each of the four identified regional clusters as well as the identification of other key areas of competitiveness external to these clusters. Sharing cluster information with employers during the focus groups

(see Perceptions of the Forces Changing Central Pennsylvania's Economy) was the first step in validating information with industry representatives. The validation process will ensure that clusters identified quantitatively fit qualitative reality.

While each phase of this methodology will be recurring as new information is discovered, the scope and continuity of the validation phase will be crucial to presenting an accurate picture of the regional economy. Anderson (1994) suggests a series of questions for continued validation with industry:

Who are your major suppliers and who are your major customers by industry segment? What approximate percentage of your production needs come within the region, and what approximate percentage of your customer markets exist within the region?...Additional questions might be asked about why the individual company is located in this region. Proximity to markets? Proximity to suppliers? Transportation systems? Quality of available workforce – managerial, professional, technical? Research centers? (Validate and Refine the Clusters section, para. 2 and 3).

Data collected from market research and executive interviews, supplemented with knowledge of available training resources and economic development strategies, will establish a solid base from which applications can be initiated.

Application

The first three steps in the Central Pennsylvania WIB's process ensured that the industry clusters identified were quantitatively sound, were generally recognized by all stakeholders and were confirmed to present a true picture of the status of the regional economy. The culminating phase, application, represents a significant departure from the first three and provides demonstrated value to the stakeholders and the region as to why industry cluster analysis is important.

In *A Governor's Guide to Creating a 21st Century Workforce*, the National Governor's Association (2002) outlined policy changes that would lead to the development of a more effectual workforce development system. At least two of those recommendations have clear ties to applications stemming from cluster analysis: "connect workforce development to economic needs and build a stronger education pipeline to produce trainable graduates" (p. 8). Industry cluster analysis has potential application in at least four spheres:

- 1) *workforce development;*
- 2) *education;*
- 3) *economic development;* and
- 4) *industry*

that must be interconnected in order for application to become result-oriented rather than solely data-driven.

Early on in the initiative, the Central Pennsylvania WIB took steps to apply the model and implement specific workforce projects stemming from the results of cluster analysis. From a workforce perspective, understanding the occupations and their required skill sets within the clusters is the fundamental first step in meeting the needs of employers. Applying the industry cluster data to the statewide employment staffing patterns, the Central Pennsylvania WIB was able to generate a list of all occupations within each cluster, an estimated number of individuals employed in each occupation, the corresponding entry-level and average wages for the occupations and corresponding skill sets required for each position.²

2 Developing a crosswalk among these elements was a time-intensive process complicated by the use of two different occupational coding structures. The statewide staffing pattern provided by the Center for Workforce Information & Analysis classifies occupations based on OES codes while wage record data collected by the Center for Workforce Information & Analysis is based on SOC codes. In a significant number of instances one OES is converted to multiple SOC codes. In order to derive the related skill sets and required occupational training, SOC code information was used to query O*Net and America's Career InfoNet at <http://online.onetcenter.org>.

The results became the basis for a revised in-demand occupation list that dictates the WIB's investment in individual training accounts (ITAs). Skill set analysis will become critical in matching labor supply and demand, particularly in times of plant closures or business expansion. The key to successfully tying workforce development to employer need is the identification of the entire spectrum of occupations within a cluster. While a self-sufficiency wage policy may place priority on higher wage occupations, it is necessary to understand those opportunities available to low-skill workers that may allow them access to a career ladder as well as the lifelong learning opportunities for the incumbent workforce.

Without a commitment from educational providers, the identification of occupations alone will not change the face of the workforce. Alignment of industry clusters with K-16 objectives will ensure that the future workforce is adequately prepared to contribute to the strength of the region's economy. In the Region, local Career & Technical Centers, responsible for serving high school and adult learners, have already committed to using the industry cluster methodology as the starting point for restructuring curriculum. Additionally, employers must have access to customized training. The business cycle will not always wait while employees complete semester-long off-the-shelf courses. Instead, training that can be delivered quickly, cover all relevant objectives and preferably be taught in-house using company equipment or software, will best meet employer needs.³

³ Currently, the Central Pennsylvania Workforce Investment Board is administering a USDOL Incumbent/Dislocated Worker Skill Shortage II Demonstration grant, which is focused on providing funding to manufacturing employers to train their incumbent workforce in information technology, plastics, welding or other high-skill manufacturing areas. Based on the 640 individuals trained to date, only nine have participated in a traditional, classroom-based off-the-shelf course.

Cluster analysis is the foundation for redesigning workforce and educational programs, but economic development supplies the strategy that will influence the future needs of employers. Industry cluster data must be utilized as economic developers create a unified regional economic development strategy that begins with the region's strengths and looks at industry recruitment as a means for industry base diversification (LeVeen, 1998). Applications for economic developers are two-fold: business retention and business recruitment. With limited resources available for infrastructure development and technology enhancements, economic developers can use the competitive advantage factors to devise an approach for business assistance. From a business retention perspective, assistance may not always be given to the most competitive establishments. Rather, funds may be targeted toward reviving a dormant industry. Additionally, cluster analysis can form the foundation for helping existing industries expand into new markets and refine the region's capacity to support their identified competency needs (Anderson, 1994). An important application will be the mapping of these clusters to determine any specific gaps (i.e. for what inputs do employers have to look outside the region). Economic developers can use this gap analysis to target specific industries during recruitment efforts or to support entrepreneurial activity (LeVeen, 1998). Firms that are looking to expand or relocate production functions may be drawn to the region because of its identified advantages (Anderson, 1994).

While workforce development, education and economic development entities can steer the route of cluster applications, industry must drive the process. First impressions may indicate that industry is a key input to analysis, but it is crucial to acknowledge the positive implications that the research and application can have for industry. Perhaps most importantly, cluster analysis brings attention to the strengths that currently exist within the economy. In rural areas like Central Pennsylvania, the geographic span of a cluster often covers a sizable area in order

to make certain that a cluster, not a strong industry presence, exists. As the National Governors Association (2003) alluded, “rural areas tend to have more diffuse business networks, as well as limited access to capital and skilled workforce pools” (p. 4). A proposed application to formalize existing industry relationships, create additional opportunity for information dissemination and issue discussion and promote the benefits of acting as a cluster, is the creation of industry-led consortia to guide the next steps of the industry cluster initiative.

Because the policy implications of cluster analysis for rural regions are in the early stages of study (LeVeen, 1998), the applications identified by the Central Pennsylvania WIB represent only the beginning stages of a collaborative strategy that infuses the strengths and potential of the region’s industry with the resources of workforce development, education and economic development.

FINDINGS FROM FOUR EMERGING INDUSTRY CLUSTERS

Finding 1

DIVERSIFIED MANUFACTURING CLUSTER

The Diversified Manufacturing Cluster (Figure 1) was designed to emphasize the importance of manufacturing in Central Pennsylvania, yet account for the deviation in the types of goods produced across the Region. Niche markets will be explored during sub-regional or county-level cluster analysis. This cluster includes nearly all goods manufacturing industries with the exception of lumber and secondary wood products, which form the foundation of the Lumber and Wood Products Cluster. To date, the Diversified Manufacturing Cluster does not include the distribution and support components of the value-chain. However, the

cluster will be further refined as input from industry on supply chains and distribution systems is collected.

Employment in the Diversified Manufacturing Cluster makes up almost 14% of the region’s workforce. Contrary to state and national trends (Shields, 2002), employment within the cluster showed an increase of almost eight percent between 1995 and 2000. National and statewide declines in manufacturing-related employment may be attributed to the decreased economic performance of manufacturing industries influenced by economic conditions that have led to plant closures and relocation to less expensive labor markets as well as continued advances in automation. When analyzing the components of the region’s growth in this cluster, national economic growth was the impetus behind the majority of the job creation. However, it is important to note that certain local advantages, which the region is in the process of defining, salvaged jobs that may have been lost due to the negative trend within the mix of industries.

An increasing LQ of 3.03 for the Diversified Manufacturing Cluster means that the cluster’s share of local employees is three times its share of national employees. The LQ increased by more than 12% over the time period. In addition to the strength of the cluster as a whole, it is important to note the strength of individual industries within the cluster. Specific industries demonstrate LQs that are up to fifty times the national concentration of employment. Industry-specific LQs, while significant, must be analyzed with guarded optimism. In many cases, one company with one location in the eleven-county area drives the LQ. On the other hand, high industry-specific LQs may point toward a niche market that warrants more attention to truly understand the unique factors that can support or grow the industry into a potential cluster.

While the regional Diversified Manufacturing Cluster outperformed statewide and national expectations, it is important to note that the statistical analysis is

based on 2000 data, which is able to tell us where we have been but does not necessarily present an accurate reflection of where we are today. Since July 1, 2001, at least 7,200 jobs have been affected by plant closures or significant layoffs that have had a significant impact on the region's manufacturing base. Although some of these layoffs have been seasonal and employees have returned to their jobs, more than 20 companies have closed their Central Pennsylvania facilities due to decreased market share, foreign competition or other factors.⁴ More analysis and concentrated validation will be required to forecast future trends in manufacturing. Based on industry growth projections provided by the CWIA, employment within the regional Diversified Manufacturing Cluster is expected to decline by approximately 100 jobs per year between 2000 and 2010 for a 10-year reduction rate of one percent.⁵

As this cluster is analyzed in more depth, it will be important to look closely at each of the manufacturing sub sectors (e.g. food processing, metal fabrication, precision instruments) in order to better understand economic trends, competitive factors, supply chains and workforce needs that may be unique. After further research, consensus building and validation, it is possible that the need for additional clusters may be recognized.

4 Data on regional dislocations due to closures or layoffs is collected through Rapid Response activities conducted by local one-stop centers and the Central Pennsylvania Workforce Development Corporation.

5 Industry Projections are based on data for the nine-county Central Regional workforce investment area, which does not include Juniata and Perry counties. However, the nine-county area is reflective of the 11-county Region. The data contained is the best available source of information for estimating job opportunities, developing training and gaining an insight into future employment trends. The projections are estimates of employment levels and trends, not exact counts. Events may occur during the ten-year projection period that are impossible to predict. This data is most useful when used in conjunction with other economic data.

Finding 2

LUMBER AND WOOD PRODUCTS CLUSTER

Lumber and wood production was removed from the Diversified Manufacturing Cluster because of its predominance in employment and competitiveness across the entire region. The Lumber and Wood Products Cluster (Figure 2) is more reflective of a whole value-chain because it includes the raw product harvested through logging, progresses through the primary production in sawmills to the value added through secondary manufacturing of wood-based products.

From 1990 to 2000, lumber and wood products was one of two manufacturing sectors included in the top ten growth sectors for rural Pennsylvania (Shields, 2002). Although the Lumber and Wood Products Cluster accounts for approximately five percent of the region's employment, it demonstrated a substantial increase in employment and LQ between 1995 and 2000. Cluster employment growth in the Region at 33% significantly out paced state and national growth in the cluster by 14% and 23% respectively. Between 1995 and 2000, the Lumber and Wood Products Cluster accounted for 20% of the total employment growth for the eleven-county area. Based on industry growth projections provided by the Center for Workforce Information and Analysis (CWIA), employment within the Lumber and Wood Products Cluster is expected to grow by approximately 100 jobs per year between 2000 and 2010 for a 10-year growth rate of 10%.

The LQ of 4.51 means that the region has over four times the national share of employment in the cluster. Based on statewide analysis of the Lumber and Wood Products Cluster, the Region is advantageously situated at the mid-point of a geographical "T" bordering the timber harvesting industries prevalent in the Northern Tier and serving as the gateway to an area of secondary manufacturing that extends to Pennsylvania's

southern border. While the cluster represents a small fraction of statewide employment, it represents significant employment for individual counties. Seven of the counties included in the Region ranked in the top 25 when all 67 counties were sorted by 2000 employment in lumber and wood products (Center for Workforce Information and Analysis, 2002).

Although the Lumber and Wood Products cluster is exhibiting strength both in employment growth and in regional competitiveness, more research will be required to understand the opportunities (i.e. availability of hardwood resources) and threats (i.e. need for modernization of primary processing techniques and movement of furniture production to foreign markets) that may affect the future of secondary wood manufacturing (Pennsylvania Hardwoods Development Council, 2002).

Finding 3

HEALTHCARE CLUSTER

The Healthcare Cluster (Figure 3) focuses on both the production of healthcare-related goods and the provision of services that promote the health and well being of residents. The Healthcare Cluster includes a full spectrum of health services including mental health, acute care, long-term care, outpatient services and medical supplies. Medical manufacturing, including laboratory analytical instruments and ultrasonic devices are included in both the Healthcare and Diversified Manufacturing clusters.⁶

Employment in the Healthcare Cluster accounts for over 13% of the region's total employment. Employment grew by over five percent between

1995 and 2000. These employment gains are reflective of trends occurring throughout rural Pennsylvania, where the largest employment gains over the last decade occurred in health services (Shields, 2002). Central Pennsylvania may attribute growing demand for health services to the increasing aging population. Between 1980 and 2000, population in the eleven-county area grew by seven percent; but the percentage of residents over the age of 65 increased by 31%. Based on industry growth projections provided by the CWIA, employment within the regional Healthcare Cluster is expected to grow by approximately 600 jobs per year between 2000 and 2010 for a 10-year growth rate of 17%. According to the Pennsylvania Department of Labor and Industry, 13 of the 25 fastest growing occupations in Pennsylvania have been identified as healthcare related (e.g. cardiovascular technologists, medical assistants and respiratory therapists).

An LQ of 1.25 (1.23 without manufacturing components) for the Healthcare Cluster implies that the region is delivering more health services than are utilized by local residents. With the presence of several large health systems, quality health services draw residents from outside the area and generate wealth for the region.

In analyzing the contributors to cluster growth, national economic growth has clearly been the driver. From the analysis, it appears that more jobs could have been created had the mix of industries exhibited stronger growth and had there been more favorable local conditions to increase competitiveness. The assumption could be made that the inability of the cluster to meet its growth potential is due to the significant shortages in nursing and other technical positions being experienced by healthcare providers nationwide as well as the medical malpractice insurance issues currently causing concern in Pennsylvania. Further analysis will focus on the capability of the region's Healthcare Cluster to keep pace with increasing demand.

⁶ It is important to note that while manufacturing components are included in two clusters, employment is only counted once when calculating the percent of the region's workforce employed in the four industry clusters.

Finding 4

EDUCATION CLUSTER

Elementary, secondary and post-secondary institutions comprise the foundation of the Education Industry Cluster (Figure 4). However, the cluster also includes the entire spectrum of education from child daycare to adult job training and rehabilitation and the administrative entities that oversee the implementation of these services.

Of the four regional clusters, the Education Cluster accounts for the greatest share (15%) of area employment and made the largest contribution to the region's total employment growth between 1995 and 2000. Based on industry growth projections provided by the CWIA, employment within the regional Education Cluster is expected to grow by approximately 700 jobs per year between 2000 and 2010 for a 10-year growth rate of 18%.

While education may typically be viewed as a non-basic industry, the presence of seven major post-secondary colleges and universities and numerous vocational-technical education providers within the Region makes the cluster more disposed to non-local conditions. The growing LQ of 1.53 statistically states that Central Pennsylvania has 1.5 times the concentration of national employment in the cluster. In addition to the prevalence of post-secondary institutions, the competitiveness is positively influenced by the rural nature of the area and the existence of thirty-three school districts.

More research on this cluster is necessary to fully understand the economic impacts of education industries on the Region. Often, the impacts are defined solely in terms of personal development or the social benefits accrued from an educated workforce. While these benefits are undoubtedly important, education must also be recognized for its economic strength, the value it adds in the form of knowledge and its role in producing a critical input for other industries. Further inquiry will be required

in order to develop appropriate supports for education as an economically-driven, not solely a service-providing, industry.

Finding 5

OCCUPATIONAL OPPORTUNITIES WITHIN THE FOUR INDUSTRY CLUSTERS

When considering the occupational opportunities available within each of the four industry clusters, perceptions are influenced by the easily observed occupations. Healthcare conjures up prestigious images of doctors and nurses, education is equated with teachers, lumber and wood products employs carpenters and diversified manufacturing continues to be associated with assemblers on the plant floor. Although these perceptions are accurate when describing the most prevalent occupations within each cluster, parochialism often precludes those outside of a cluster from truly understanding the variety of job titles, skill sets and abilities that contribute to a workforce.

In order to accurately identify all occupations within each of the four clusters, the Central Pennsylvania WIB applied regional staffing patterns to the cluster.⁷ The occupational estimates were then aligned with average wage data and skill training requirements for the four industry clusters. From the initial results, it is apparent that each cluster relies on a different segment of the workforce to provide the foundation of skilled workers. As the chart below illustrates, healthcare is extremely reliant on two areas of training – post-secondary certification and short

⁷ CWIA constructs statewide and regional staffing patterns every two years. The staffing pattern utilized for this report is based on 1998 data, which is applied to 2000 employment data. Existing staffing patterns are based on SIC industrial coding and will require considerable revision to properly capture new occupational titles stemming from the NAICS conversion. Staffing patterns are updated using OES Survey responses from employers, industry projections and an employer survey of the non-covered group (self-employed, domestic and non-covered agriculture).

term on-the-job training, which is reflective of the growing need for health technicians and service support staff. The Education Cluster offers the largest percentage of employment opportunities for individuals with advanced degrees. Although the Lumber and Wood Products cluster depends on individuals who can acquire skills on the job, most of that training takes longer than 12 months. The greatest percentage of occupations within the Diversified Manufacturing cluster can be obtained with moderate or short-term on-the-job training that can take as long as 12 months or as little as a week to acquire.

It is important to note that even though each cluster exhibits a natural inclination toward a particular occupational grouping, all clusters offer employment opportunities in each of the six training classifications. As technology continues to advance, the benefits of post-secondary training may outweigh the costs in time and personnel in developing workers through on-the-job training alone. Additionally, the training classifications, as defined by the Bureau of Labor Statistics, are meant to serve as guides for minimum skill levels. Ultimately the demands and processes of each unique employer will determine the skill requirements for a specific occupation. Skill training and occupations should not be examined from a static standpoint; skill acquisition will not conclude with the completion of a degree or on-the-job training but rather require progressive learning throughout an employee's work life.

The assumption may be made that a cluster's average annual wage has a direct correlation to the most prevalent occupations within the cluster, thus inferring that a cluster dominated by occupations requiring short-term on-the-job training would have a lower average annual wage than those dominated by advanced degree occupations. It is interesting to note that because the clusters employ individuals along the occupational spectrum, the average annual wages varied by only \$3,419 from the midpoint. In fact, of the region's four clusters, the Diversified

Manufacturing Cluster with its reliance on on-the-job training offered the highest average annual wage.

The information provided in Tables 1 through 4 highlights the most prevalent occupations, their corresponding skill level requirements and average regional wage data. The next step will require further investigation into the skill sets required by and acquired through these occupations. Skill set analysis will lead to the development of occupational clusters that cross industry clusters. Occupational clusters will provide a means for identifying additional commonalities between industry clusters and examine methods for expediting the transfer of skills from one cluster to another in the case of dislocations.

CONCLUSION

The background on industry cluster analysis and the findings specific to the eleven-county region of Central Pennsylvania presented in this report are meant to stir readers to consider the applications and implications that a similar process could have on other regions attempting to develop a unified, industry-driven community development strategy. Locally, industry cluster analysis has increased regional awareness of four major economic engines: Diversified Manufacturing, Lumber and Wood Products, Healthcare and Education. Together these clusters account for over 50% of the Central Region's employment and through supply and distribution chains affect an even greater percentage of the workforce. The Central Pennsylvania WIB began using the industry cluster model because of a micro interest in targeting limited resources to individual industries. However, the model has quickly provided the capability for the WIB and its partners to increase the understanding of the macro economy, its strengths, its needs and its opportunities. By moving from a point-in-time model to a systematic, non-linear process of research and analysis, consensus building, validation and application, the Central Pennsylvania WIB has not pursued this initiative on its own. Realizing that

community development will not occur without buy-in to the process, the Central Pennsylvania WIB has created opportunities for stakeholders to access the process from a number of avenues and at different times. The continuous process also stresses the Central Pennsylvania WIB's desire to revisit the model as economic circumstances change and to use the model to change economic circumstances.

While the benefits of this process may be evident to those who have been deeply involved in the work, it is important to reiterate the reasons for considering industry cluster analysis: 1) data availability; 2) functional results; and 3) limitless applications.

Data Availability

Industry cluster analysis is not a new creation; rather it is an evolution of traditional techniques used to promote industry competitiveness and develop workforce and economic development policies. The Central Pennsylvania WIB's initiative was not prompted by the release of new data, but the model requires users to reconfigure existing data into a new product. To illustrate, rather than relying solely on ten-year industry projections, analysis of industry clusters involves combining projections with other measures, such as competitiveness, economic prosperity, cluster dependency and labor pool availability, and other tools (e.g. input-output analysis, input-output models, trend analysis based on quarterly data, occupational forecasts and economic prosperity analysis) to present a comprehensive representation of the economy. To validate the quantitative findings, industry cluster analysis also calls on the qualitative knowledge that workforce development, education and economic development practitioners have acquired through executive interviews, meetings with prospective companies or surveys.

Functional Results

Although the process is time-intensive, industry cluster analysis demonstrates utility in its ability to serve as common language between industry, workforce development, economic development

and education. A systematic process of identifying industry clusters can transform instincts into reliable, substantiated reasons for economic and workforce investment. Rosenfeld (2002) argues that areas struggling with the ability to compete often "do not realize their potential due, for example, to insufficient specialization to achieve scale economies; fragmented public sector support; [or] lack of knowledge or inability to take advantage of commonalities" (p. 25). The strength of this model is in the ability to move from research to function by serving as common language between industry, workforce development, economic development and education.

Boundless Applications

Once data becomes information, the possible applications, which are only briefly identified in this report, are far-reaching. The potential to move between and synchronize clusters, industries, occupations and skill sets provides economic development, education and workforce development agencies with a much more detailed understanding of industry. Unsuccessful attempts at development occur when intermediaries make decisions based on too little information on the environment in which industry operates. Industry engagement through formalized consortium or informal paths of communication is crucial to the legitimacy and impact of cluster-based applications.

The Central Pennsylvania WIB envisions applications for workforce development, education and economic development. To support the workforce within the clusters, the Central Pennsylvania WIB is currently dedicating further study to the clusters' dependence on a spectrum of occupations and their corresponding skill sets. Eventually, the formation of occupational clusters that recognize similarities in function and competency, rather than work setting, will be critical to assisting the incumbent workforce identify career paths within and across industry clusters.

Using industry cluster data as the starting point for cluster forecasting will allow the region to project future demand for occupations. As efforts to encourage young adults to remain in or return to Pennsylvania persist, regional partners must deliver a clear message about the opportunities that exist for individuals with varying skill levels. To adequately meet the future demands with a trained workforce, the K-12 system must align curricula with industry standards and post-secondary training programs should have the capacity to deliver short-term, customized training together with certification programs that promote lifelong learning.

Development of a diverse, competitive economy takes years and efforts to support or transform that economic base will not be changed quickly. However, using cluster analysis as the foundation for business recruitment and retention strategies will increase an area's ability to sustain and wisely manage economic growth. In the long-term, understanding the economic impacts and potential for development of the clusters could spur entrepreneurial activity, promote further co-location of cluster industries and ultimately lead to diversification within the regional economy.

In addition to considering the benefits of cluster-based approaches, those considering implementing the industry cluster model must also acknowledge the limitations. Industry cluster analysis is not a magic bullet; it represents a fresh framework for examining deep-rooted economic issues. Mastering the quantitative tools will only produce a picture of what has been, what is and what should be. Industry cluster analysis is not a unilateral undertaking. If a single stakeholder initiates cluster analysis, even the most reliable data and most relevant applications will not lead to the widespread potential developed only through broad consensus building activities. Industry clusters are not one-size-fits-all. They must be massaged, studied and reassessed to truly reflect a region's competitive strengths. Industry cluster analysis is not final. As the deeply embedded networks that support the

diverse economy evolve and grow, the ability of workforce development, education and economic development to effectively coordinate responses will influence the long-term impact resulting from the creation of new clusters and perhaps even the decline of mature clusters.

The four-phased methodology described in this report openly acknowledges the limitations of industry cluster analysis by carefully defining a continuous strategy that is substantiated, coordinated and validated. In anticipating the limitations, the Central Pennsylvania WIB's methodology will increase the benefits to the region through sophisticated support to the existing and emerging industries.

The data presented in Tables 1 through 4 identify the most prevalent occupations for each of the four industry clusters. The estimated 2000 employment is based upon Central Pennsylvania Workforce Investment Area staffing patterns as applied to the 2000 employment in the counties of Centre, Clinton, Columbia, Juniata, Lycoming, Mifflin, Montour, Northumberland, Perry, Snyder and Union. All wages are regional averages for 2000 based on data collected through employer surveys administered by the Center for Workforce Information and Analysis. The minimum skill level requirement is based on classifications assigned by the Bureau of Labor Statistics. These skill requirements serve as a guide only; individuals with greater or lesser skill attainments may be employed in these occupations.

Disclaimer: This data is based on estimated staffing patterns, average earnings and minimum skill requirements and should be reviewed with the understanding it may not reflect current staffing patterns or recent economic events.

Figure 1. Summary of Diversified Manufacturing Cluster



Source: All data was provided by the Pennsylvania Department of Labor and Industry's Center for Workforce Information and Analysis (CWIA) for the period 1995 to 2000. Clusters were defined by the Central Pennsylvania Workforce Development Corporation, 2002. Data last updated on May 20, 2003.

Figure 2. Summary of Lumber & Wood Products Cluster.



Source: All data was provided by the Pennsylvania Department of Labor and Industry's Center for Workforce Information and Analysis (CWIA) for the period 1995 to 2000. Clusters were defined by the Central Pennsylvania Workforce Development Corporation, 2002. Data last updated on May 20, 2003.

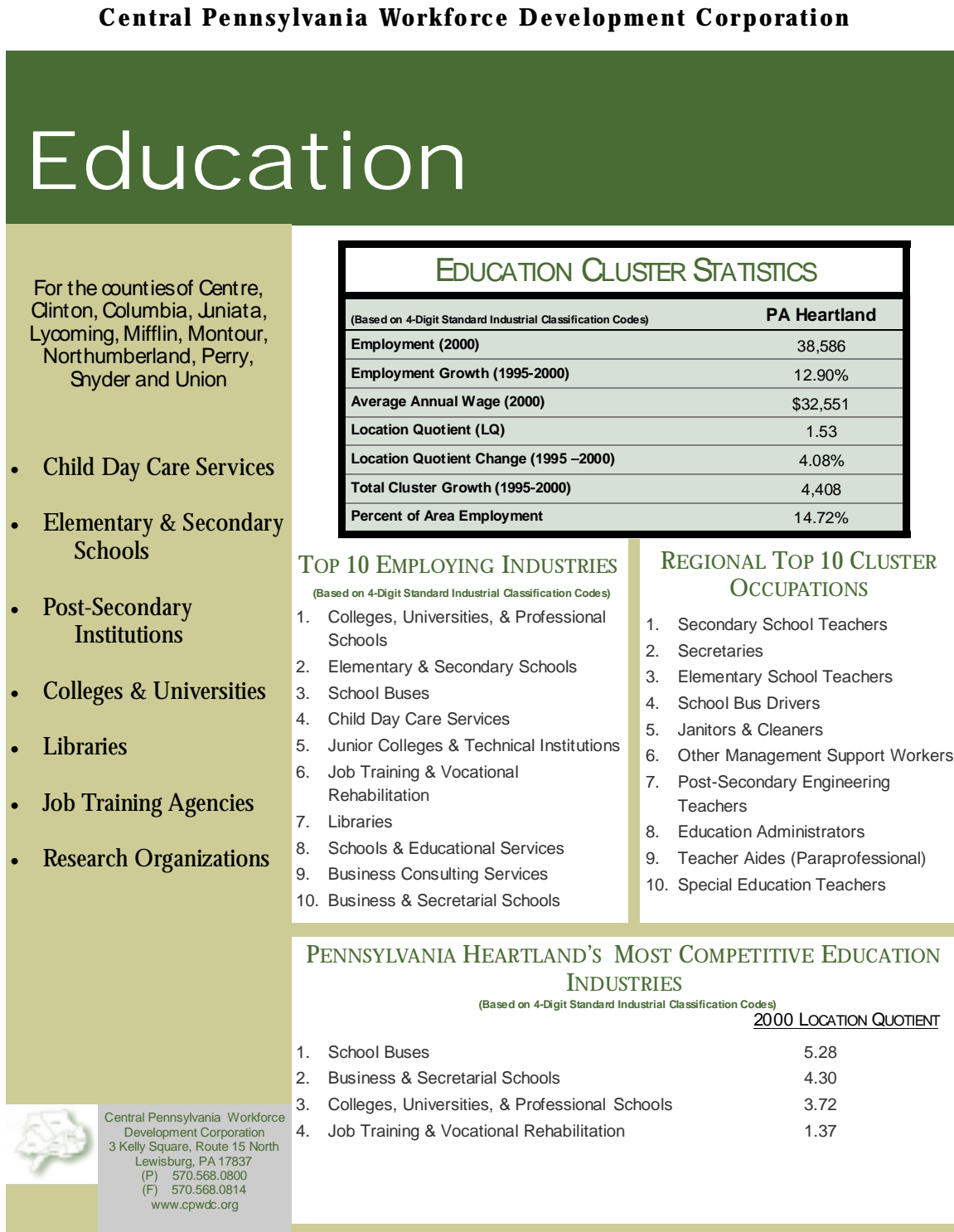
Figure 3. Summary of Healthcare Cluster.

Central Pennsylvania Workforce Development Corporation



Source: All data was provided by the Pennsylvania Department of Labor and Industry's Center for Workforce Information and Analysis (CWIA) for the period 1995 to 2000. Clusters were defined by the Central Pennsylvania Workforce Development Corporation, 2002. Data last updated on May 20, 2003.

Figure 4. Summary of Education Cluster.



Source: All data was provided by the Pennsylvania Department of Labor and Industry's Center for Workforce Information and Analysis (CWIA) for the period 1995 to 2000. Clusters were defined by the Central Pennsylvania Workforce Development Corporation, 2002. Data last updated on May 20, 2003.

Table 1. Diversified Manufacturing occupations: Employment, education and compensation estimates for the Pennsylvania Heartland: 2000.

OES Code	Occupation	2000 Estimated Employment	Average Hourly Wage	Average Annual Salary	Average Entry Annual Salary
Occupations Requiring Credentials Received through Experience Beyond a Degree or On-the-job Training					
81008	First Line Supervisors of Production & Operations Workers	1100	\$17.86	\$37,141	\$26,523
Occupations Requiring Advanced Training Offered through a Bachelor's Degree or Higher					
19005	General Managers & Top Executives	480	\$26.21	\$54,519	\$34,797
15014	Industrial Production Managers	310	\$24.15	\$50,237	\$29,367
22126	Electrical & Electronics Engineers	230	\$30.63	\$63,700	\$43,920
Occupations Requiring Post-Secondary Training through an Associate Degree or Certificate					
93914	Welders & Cutters	460	\$13.50	\$28,080	\$20,532
22505	Electrical & Electronic Technicians & Technologists	230	\$13.58	\$28,252	\$20,613
Occupations Requiring Long Term On-the-Job Training Greater than 12 Months in Length					
85110	Industrial Machinery Mechanics	720	\$16.25	\$33,800	\$24,474
89108	Machinists	660	\$14.11	\$29,354	\$23,325
85132	Maintenance Repairers, General Utilities	460	\$12.26	\$25,491	\$17,222
89805	Bakers, Manufacturing	240	\$10.29	\$21,408	\$18,876
87202	Electricians	240	\$13.55	\$28,187	\$19,033
Occupations Requiring Moderate On-the-Job Training Between 1 month and 12 months in Length					
93956	Assemblers/Fabricators	2460	\$9.93	\$20,654	\$16,318
93999	Other Hand Workers	780	\$13.53	\$28,143	\$14,477
83005	Inspectors/Testers/Graders/Samplers/Weighers	750	\$11.87	\$24,679	\$18,725
92998	Other Machine Operators/Tenders	470	\$13.53	\$28,143	\$14,477
91705	Welding Machine Operators/Tenders	450	\$13.59	\$28,267	\$22,040
91905	Plastic Mold/Cast Machine Operators/Tenders	440	\$10.31	\$21,434	\$16,349
92914	Paper Goods Machine Setters/Operators	430	\$10.64	\$22,124	\$18,180
97102	Truck Drivers, Heavy	410	\$11.09	\$23,074	\$13,863
55108	Secretaries, Except Legal or Medical	360	\$13.36	\$27,792	\$18,760
92953	Coat/Paint/Spray Machine Operators/Tenders	350	\$10.48	\$21,805	\$18,102
92543	Printing Press Machine Operators/Tenders	350	\$13.49	\$28,057	\$21,419
91714	Metal Fabricators, Structural Metals	300	\$11.85	\$24,650	\$22,987
92935	Chemical Equipment Controllers/Operators	290	\$17.22	\$35,810	\$27,900
91321	Machine Forming Operators/Tenders	280	\$10.13	\$21,072	\$19,451
49008	Manufacturing & Wholesale Sales Representatives	280	\$17.95	\$37,333	\$21,742
55338	Bookkeeping/Accounting/Auditing Clerks	270	\$10.42	\$21,664	\$16,450
92971	Extruding/Forming/Precision Machine Operators/Tenders	250	\$11.47	\$23,852	\$17,858
91305	Press Machine Setters/Operators	250	\$11.74	\$24,414	\$17,327
92721	Sewing Mach Operators, Non-Garment	250	\$7.35	\$15,281	\$12,189
92965	Crush/Grinding/Mix Mach Operators/Tenders	230	\$11.03	\$22,949	\$16,568
Occupations Requiring Short Term On-the-Job Training of 1 month or less					
93114	Electrical/Electronic Equipment Assemblers, Precision	1750	\$9.86	\$20,505	\$14,585
98902	Hand Packers & Packagers	1150	\$8.76	\$18,213	\$14,005
97947	Industrial Truck & Tractor Operators	880	\$12.12	\$25,207	\$19,480
98999	Helpers/Laborers/Movers	860	\$9.29	\$19,329	\$14,160
93105	Machine Builder Assemblers, Precision	780	\$13.30	\$27,660	\$21,830
98799	Freight/Stock/Movers	720	\$9.29	\$19,329	\$14,160
98502	Machine Feeders & Offbearers	680	\$9.66	\$20,096	\$15,902
93935	Cannery Workers	620	\$10.33	\$21,487	\$16,793
92974	Packaging/Filling Machine Operators/Tenders	610	\$10.66	\$22,164	\$18,055
58028	Shipping/Receiving/Traffic Clerks	590	\$10.96	\$22,802	\$15,728
93905	Electrical/Electronic Assemblers	470	\$9.86	\$20,505	\$14,585
67005	Janitors & Cleaners	360	\$9.00	\$18,713	\$12,823
58008	Production/Planning/Expediting Clerks	300	\$14.52	\$30,195	\$20,292
55347	Office Clerks, General	300	\$10.16	\$21,136	\$14,539
55323	Order Clerks	260	\$10.14	\$21,084	\$14,531
58023	Stock Clerks: Stockroom/Warehouse/Yard	240	\$7.47	\$15,544	\$12,448

The preceding data identifies the occupations which employed at least 230 individuals in 2000. These occupations were derived from the Diversified Manufacturing Industry Cluster which the Central Pennsylvania Workforce Development Corporation (CPWDC) has defined to include the following Standard Industrial Classification (SIC) Codes: 2000 Food And Kindred Products; 2100 Tobacco Products; 2200 Textile Mill Products; 2300 Apparel And Other Finished Products Made From Fabrics And Similar Materials; 2600 Paper And Allied Products; 2700 Printing, Publishing, And Allied Industries; 2800 Chemicals And Allied Products; 2900 Petroleum Refining And Related Industries; 3000 Rubber And Miscellaneous Plastics Products; 3100 Leather And Leather Products; 3200 Stone, Clay, Glass, And Concrete Products; 3300: Primary Metal Industries; 3400 Fabricated Metal Products, Except Machinery And Transportation Equipment; 3500 Industrial And Commercial Machinery And Computer Equipment; 3600 Electronic And Other Electrical Equipment And Components, Except Computer Equipment; 3700 Transportation Equipment; 3800 Measuring, Analyzing, And Controlling Instruments; 3900 Miscellaneous Manufacturing Industries.

Table 2. Lumber and Wood Products occupations: Employment, education and compensation estimates for the Pennsylvania Heartland: 2000.

OES Code	Occupation	2000 Estimated Employment	Average Hourly Wage	Average Annual Salary	Average Entry Annual Salary
Occupations Requiring Credentials Received through Experience Beyond a Degree or job Training					
81008	First Line Supervisors of Production & Operations Workers	420	\$17.86	\$37,141	\$26,523
81017	First Line Supervisors of Helpers & Laborers	90	\$18.46	\$38,394	\$23,180
Occupations Requiring Advanced Training Offered through a Bachelor's Degree or Higher					
19005	General Managers & Top Executives	230	\$26.21	\$54,519	\$34,797
15014	Industrial Production Managers	130	\$24.15	\$50,237	\$29,367
Occupations Requiring Post-Secondary Training through an Associate Degree or Certificate					
22514	Drafters	90	\$15.65	\$32,543	\$21,807
Occupations Requiring Long Term On-the-Job Training Greater than 12 Months in Length					
93956	Assemblers/Fabricators, Except Machine/Electrical/Precision	1790	\$9.93	\$20,654	\$16,318
92311	Woodworking Machine Setters, Except Sawing	690	\$11.29	\$23,483	\$19,374
89308	Wood Machinists	640	\$11.29	\$23,483	\$19,374
89311	Cabinetmakers/Bench Carpenters	520	\$10.06	\$20,921	\$14,576
87102	Carpenters	470	\$12.50	\$26,009	\$21,375
89305	Wood Pattern Markers	370	\$11.35	\$23,598	\$16,903
89314	Furniture Finishers	270	\$11.69	\$24,320	\$17,330
89508	Upholsterers	110	\$11.69	\$24,313	\$20,543
85132	Maintenance Repairers, General Utilities	110	\$12.26	\$25,491	\$17,222
87202	Electricians	100	\$13.55	\$28,187	\$19,033
85110	Industrial Machinery Mechanics	80	\$16.25	\$33,800	\$24,474
Occupations Requiring Moderate On-the-Job Training Between 1 month and 12 months in Length					
92314	Woodworking Machine Operators/Tenders, Except Sawing	520	\$11.29	\$23,483	\$19,374
92308	Sawing Machine Operators/Tenders	480	\$11.00	\$22,885	\$18,320
97102	Truck Drivers, Heavy	300	\$14.56	\$30,291	\$20,172
49008	Sales Representatives, Manufacturing and Wholesale	160	\$17.95	\$37,333	\$21,742
55338	Bookkeeping/Accounting/Auditing Clerks	120	\$10.42	\$21,664	\$16,450
83005	Inspectors/Testers/Graders/Samplers/Weighers	110	\$11.87	\$24,679	\$18,725
55108	Secretaries, Except Legal or Medical	100	\$9.51	\$19,778	\$13,516
87602	Carpet Installers	80	\$10.10	\$21,012	\$15,528
87402	Painters & Paperhangers	80	\$12.79	\$26,594	\$19,450
Occupations Requiring Short Term On-the-Job Training of 1 month or less					
98799	Other Hand Freight/Stock/Movers	480	\$9.29	\$19,329	\$14,160
98502	Machine Feeders & Offbearers	460	\$9.66	\$20,096	\$15,902
98999	Other Helpers/Laborers/Movers	380	\$9.29	\$19,329	\$14,160
87999	Other Construction/Extractive Workers	260	\$11.53	\$23,991	\$15,072
55347	Office Clerks, General	250	\$10.16	\$21,136	\$14,539
97947	Industrial Truck & Tractor Operators	170	\$12.12	\$25,207	\$19,480
98902	Hand Packers & Packagers	170	\$8.76	\$18,213	\$14,005
58023	Stock Clerks: Stockroom/Warehouse/Yard	110	\$7.47	\$15,544	\$12,448
67005	Janitors & Cleaners	110	\$9.00	\$18,713	\$12,823
58028	Shipping/Receiving/Traffic Clerks	100	\$10.96	\$22,802	\$15,728

The preceding data identifies the occupations which employed at least 80 individuals in 2000. These occupations were derived from the Lumber and Wood Products Cluster which the Central Pennsylvania Workforce Development Corporation (CPWDC) has defined to include the following Standard Industrial Classification (SIC) Codes: 1750 Carpentry & Floor Work; 2410 Logging; 2420 Sawmills & Planing Mills; 2430 Millwork, Plywood & Structural Members; 2440 Wood Containers; 2450 Wood buildings & Mobile Homes; 2490 Miscellaneous Wood Products; 2510 Household Furniture; 2520 Office Furniture; 2540 Partitions & Fixtures; 5030 Lumber & Construction Materials.

Table 3. Healthcare occupations: Employment, education and compensation estimates for the Pennsylvania Heartland: 2000.

OES Code	Occupational Title	Estimated 2000 Employment	Average Hourly Wage	Average Annual Salary	Entry Annual Wage
Occupations Requiring Credentials Received through Experience Beyond a Degree or On-the-Job Training					
51002	Managers of Office & Administrative Support	470	\$14.40	\$29,959	\$20,532
19999	Other Managers & Administrators	260	\$18.21	\$37,879	\$21,855
Occupations Requiring Advanced Training Offered through a Bachelor's Degree or Higher					
32102	Physicians & Surgeons	910	\$38.81	\$80,726	\$63,195
19005	General Managers & Top Executives	470	\$26.21	\$54,519	\$37,797
15008	Medical & Health Service Managers	460	\$26.17	\$54,426	\$36,264
32517	Pharmacists	310	\$31.81	\$66,158	\$57,980
32902	Medical/Clinical Lab Technologists	290	\$18.84	\$39,180	\$32,789
27302	Social Workers, Medical/Psychiatric	220	\$14.14	\$29,410	\$20,620
32308	Physical Therapists	210	\$27.90	\$58,036	\$43,484
Occupations Requiring Post-Secondary Training through an Associate Degree or Certificate					
32502	Registered Nurses	4400	\$18.94	\$39,390	\$29,570
32505	Licensed Practical Nurses	2000	\$12.63	\$26,278	\$21,983
55105	Medical Secretaries	580	\$10.18	\$21,172	\$15,557
32508	Emergency Medical Technicians / Paramedics	530	\$9.45	\$19,651	\$13,934
32908	Dental Hygienists	430	\$18.23	\$37,921	\$33,293
32919	Radiologic Technicians/Technologists	380	\$20.92	\$43,522	\$36,214
32302	Respiratory Therapists	370	\$18.69	\$38,872	\$30,934
32999	Other Health Professionals/Paraprofessionals	330	\$13.89	\$28,894	\$23,119
66017	Physical Therapy Assistants/Aides	250	\$13.41	\$27,896	\$21,788
32905	Medical/Clinical Laboratory Technicians	200	\$15.35	\$31,929	\$22,092
Occupations Requiring Long Term On-the-Job Training Greater than 12 Months in Length					
65028	Cooks, Institution/Cafeteria	250	\$8.29	\$17,235	\$14,426
85132	Maintenance Repairers, General Utility	210	\$12.26	\$25,491	\$17,222
Occupations Requiring Moderate On-the-Job Training Between 1 and 12 months in Length					
55108	Secretaries, Except Legal or Medical	750	\$9.51	\$19,778	\$13,516
27307	Residential Counselors	480	\$9.24	\$19,212	\$12,513
66002	Dental Assistants	410	\$9.91	\$20,620	\$15,848
92935	Chemical Equipment Controllers/Operators	210	\$17.22	\$35,810	\$27,900
92726	Laundry/Drycleaning Machine Operators	210	\$8.03	\$16,703	\$13,790
55338	Bookkeeping/Accounting/Auditing Clerks	210	\$10.42	\$21,664	\$16,450
Occupations Requiring Short Term On-the-Job Training of 1 month or less					
66008	Nursing Aides	4100	\$8.99	\$18,699	\$15,333
55347	General Office Clerks	810	\$10.16	\$21,136	\$14,539
49023	Cashiers	790	\$7.00	\$14,552	\$12,280
67002	Maids & Housekeeping Cleaners	670	\$7.28	\$15,156	\$12,236
55305	Reception & Information Clerks	590	\$8.93	\$18,580	\$15,108
65038	Food Preparation Workers	460	\$7.89	\$16,406	\$12,208
66011	Home Health Aides	410	\$8.20	\$17,062	\$14,787
55344	Billing/Cost/Rate Clerks	370	\$10.24	\$21,290	\$16,659
66099	Other Health Service Workers	360	\$9.76	\$20,304	\$14,529
68035	Personal/Home Care Aides	300	\$7.28	\$15,152	\$12,183
67005	Janitors & Cleaners	240	\$9.00	\$18,713	\$12,823
93114	Precision Electrical/Electronic Equipment Assemblers	210	\$9.86	\$20,505	\$14,585

The preceding data identifies the occupations which employed at least 200 individuals in 2000. These occupations were derived from the Healthcare Industry cluster which the Central Pennsylvania Workforce Development Corporation (CPWDC) has defined to include the following Standard Industrial Classification (SIC) Codes: 2830 Drugs; 3820 Measuring & Controlling Devices; 3840 Medical Instruments & Supplies; 3850 Ophthalmic Goods; 4110 Local & Suburban Transportation; 4520 Air Transportation, Nonscheduled; 5040 Professional and Commercial Equipment; 5910 Drug Stores and Proprietary Stores; 6320 Medical Service and Health Insurance; 7350 Miscellaneous Equipment Rental and Leasing; 8010 Offices of Medical Doctors; 8020 Offices of Dentists; 8030 Offices of Osteopathic Physicians; 8040 Offices of Other Health Practitioners; 8050 Nursing and Personal Care Facilities; 8060 Hospitals; 8070 Medical and Dental Labs; 8080 Home Health Care Services; 8090 Health and Allied Services, Not Elsewhere Classified; and 8360 Residential Care.

Table 4. Education occupations: Employment, education and compensation estimates for the Pennsylvania Heartland: 2000.

OES Code	Occupation	2000 Estimated Employment	Average Hourly Wage	Average Annual Salary	Average Entry Annual Salary
Occupations Requiring Credentials Received through Experience Beyond a Degree or On-the-Job Training					
19999	Other Managers & Administrators	400	\$18.21	\$37,879	\$21,855
61099	Other Managers of Service Personnel	310	\$14.96	\$31,124	\$15,713
51002	Managers of Office & Administrative Support	200	\$14.40	\$29,959	\$20,532
Occupations Requiring Advanced Training Offered through a Bachelor's Degree or Higher					
31308	Teachers, Secondary School	4100	N/A	\$45,599	\$31,261
31305	Teachers, Elementary School	2400	N/A	\$45,726	\$33,404
21999	Other Management Support Workers	1500	\$18.51	\$38,496	\$21,986
31222	Engineering Teachers, Postsecondary	960	N/A	\$74,140	\$40,130
15005	Education Administrators	920	N/A	\$64,987	\$50,836
31311	Teachers, Special Education	850	N/A	\$44,523	\$30,885
31209	Phys Science Teachers, Postsecondary	460	N/A	\$58,950	\$32,270
31314	Teachers/ Instructors, Vocational Education/Trainers	380	N/A	\$30,703	\$20,297
31202	Life Sciences Teachers, Postsecondary	360	N/A	\$57,110	\$31,790
31218	Art/Drama/Music Teachers, Postsecondary	360	N/A	\$52,590	\$25,810
31303	Teachers, Preschool	320	\$7.50	\$15,609	\$12,166
31502	Librarians	300	\$22.19	\$46,156	\$28,994
19005	General Managers & Top Executives	290	\$26.21	\$54,519	\$34,797
31299	Other Postsecondary Teachers	280	N/A	\$53,850	\$25,550
31514	Counselors, Vocation/Education	260	\$19.94	\$41,483	\$31,689
31224	Math/Science Teachers, Postsecondary	250	N/A	\$53,190	\$27,890
25105	Computer Programmers	240	\$21.60	\$44,932	\$30,323
31304	Teachers, Kindergarten	240	N/A	\$42,005	\$28,696
22199	Other Engineers	200	\$25.69	\$53,425	\$36,937
31399	Other Teachers & Instructors	190	N/A	\$30,703	\$20,297
31114	Nursing Instructors	160	N/A	\$49,217	\$34,969
Occupations Requiring Post-Secondary Training through an Associate Degree or Certificate					
32502	Registered Nurses	180	\$18.94	\$39,390	\$29,570
Occupations Requiring Long Term On-the-Job Training Greater than 12 Months in Length					
85132	Maintenance Repairers, General Utilities	750	\$12.26	\$25,491	\$17,222
65028	Cooks, Institution/Cafeteria	580	\$8.29	\$17,235	\$14,426
31321	Instructors/Coaches, Sports & Physical Training	480	N/A	\$24,365	\$12,172
Occupations Requiring Moderate On-the-Job Training Between 1 month and 12 months in Length					
55108	Secretaries, Except Legal or Medical	3750	\$9.51	\$19,778	\$13,516
85999	Other Mechanics/Installers/Repairers	610	\$14.41	\$29,965	\$17,935
39999	Other Professional/Paraprofessional/Technicians	350	\$16.61	\$34,540	\$20,480
55307	Word Processors & Typists	230	\$12.88	\$26,799	\$21,488
55338	Bookkeeping/Accounting/Auditing Clerks	210	\$10.42	\$21,664	\$16,450
49999	Other Sales & Related Workers	170	\$13.24	\$27,549	\$13,886
Occupations Requiring Short Term On-the-Job Training of 1 month or less					
97111	Bus Drivers, School	1720	\$7.82	\$16,269	\$12,224
67005	Janitors & Cleaners	1650	\$9.00	\$18,713	\$12,823
31521	Teacher Aides, Paraprofessional	900	N/A	\$21,932	\$12,982
53905	Teacher Aides/Educational Assistants	770	N/A	\$21,932	\$12,982
68038	Child Care Workers	700	\$7.55	\$15,697	\$12,256
65038	Food Preparation Workers	630	\$7.89	\$16,406	\$12,208
53902	Library Assistants/Bookmobile Drivers	310	\$9.95	\$20,699	\$12,785
55347	General Office Clerks	300	\$10.16	\$21,136	\$14,539
59999	Other Administrative Support/Clerical Workers	290	\$10.60	\$22,049	\$14,805
65099	Other Food Service Workers	260	\$8.21	\$17,072	\$12,268
69999	Other Service Workers	210	\$7.45	\$15,487	\$12,257
79999	Other Agriculture/Forestry/Fishing Workers	190	\$12.56	\$26,119	\$17,001
31505	Library Technicians	160	\$10.86	\$22,585	\$14,748

The preceding data identifies the occupations which employed at least 150 individuals in 2000. These occupations were derived from the Education Cluster which the Central Pennsylvania Workforce Development Corporation (CPWDC) has defined to include the following Standard Industrial Classification (SIC) Codes: 2741 Miscellaneous Publishing; 4151 School Buses; 8211 Elementary & Secondary Schools; 8221 Colleges, Universities, & Professional; 8222 Junior Colleges & Technical Institutions; 8231 Libraries; 8244 Business & Secretarial Schools; 8249 Vocational Schools; 8299 Schools & Educational Services; 8331 Job Training & Vocational Rehabilitation; 8351 Child Day Care Services; 8732 Commercial Economic, Sociological Research; 8733 Noncommercial Research Organizations; 8748 Business Consulting Services; 9411 Administration of Educational Programs.

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