Examining Strategies for Cluster-Based Economic Development in Rural Iowa

Prepared by:
The Institute for Decision Making
Business and Community Services
University of Northern Iowa
Cedar Falls, IA

Funded by:
Community Vitality Center
Ames, IA

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Introduction and Overview of the Project

Industry clusters have grown to be a point of emphasis for many elected officials, economic development policy makers and economic development professionals at the regional and national level not only in the United States but also around the world. Cluster-based strategies focus on groups of firms that have interdependence, as opposed to traditional economic development strategies, which target individual firms. The premise of such an economic development strategy is, that through the clustering of competitive firms, the region in which these establishments are located, will achieve an economic competitive advantage.

Within the U.S., several states, specifically Arizona and Oregon, were early adopters of cluster-based economic development strategies. At present, Arizona's cluster focus includes an aerospace industry cluster, a semiconductor and computer electronics components industry cluster, an emerging optics cluster and a bio-technology industry cluster. Arizona's bio-technology industry cluster encompasses drug and medical device research and development, drug manufacturing, medical devices and instruments manufacturing and software and services (Arizona Department of Commerce, 2003). Oregon is shaping its economic development strategies around industry clusters such as wood products, food processing, metals and machinery, high tech and travel and tourism (The Oregon Business Plan, 2003).

Currently, most states and countless communities and regions are focusing on cluster-based economic development strategies to grow their economies. Iowa is no exception. In 2000, the Iowa Department of Economic Development (IDED) released *Iowa Target Industry Cluster Analysis* (IDED, 2003) that was completed by SRI International. This study identified three major clusters in the state: life sciences, information solutions and advanced manufacturing. The State of Iowa has since been focusing much of its economic development strategy on building upon these three major clusters.

A few Iowa communities and regions have begun to shape their economic development efforts around cluster-based strategies. Examples include the Iowa City-Cedar Rapids Technology Corridor, Mason City and Clear Lake and a regional effort that includes Fort Dodge, Iowa Falls and Webster City. These regional collaborations have been motivated, in part, by the state's cluster research and funding opportunities. If IDED focuses more of its efforts on the state's clusters and more of state funding for business incentives and community assistance being

built around those clusters, more and more communities and regions are likely to focus on cluster-based development.

Communities and regions face significant challenges in shifting their economic development strategies to a cluster focus. One challenge is identifying which industry clusters might have a presence in their region and determining how that local economic base ties into to the state's identified clusters. A second challenge is understanding the cluster dynamics that exist or could exist between firms, within and across industries and in partnership with support institutions such as colleges and universities, and government entities. A third challenge is to balancing the development and implementation of appropriate economic development strategies that strengthen the region's existing economic base, building on any industry cluster presence and enabling them to link into the state's industry clusters. This balancing act will be even more pronounced for rural communities and regions around the state.

To help examine some of these challenges, the Institute for Decision Making (IDM) at the University of Northern Iowa received funding from the Community Vitality Center to assist three pilot regions in Iowa to better understand their economic base and to identify any industry cluster presence. Funding also enabled IDM to assist pilot regions in identifying potential economic development strategies that strengthen their existing economic base and clusters and enable them to capitalize on the state's industry clusters. This report is one component of this project.

The first section of this report provides an overview of industry clusters and why industries cluster. The benefits and challenges of industry clustering is also discussed in the section. The second section of this report discusses the challenges related to identifying and quantifying a region's industry clusters.

The third section of the report details a framework for applied regional cluster analysis that has been developed by researchers at the University of North Carolina and the University of Vienna. This framework has identified benchmark value-chain industry clusters, benchmark technology industry clusters and benchmark labor clusters based on the interactions of industries, technology and occupation/skills at a national level. In this section, the framework is applied to the U.S. and Iowa separately. In addition, this framework for applied regional cluster analysis has been utilized to develop separate cluster reports for the three pilot regions: the Iowa Great Lakes Region (Clay, Dickinson and Emmet counties), the Southeast Iowa Region (Des Moines,

Henry and Lee counties) and the Carroll Region (Audubon, Carroll, Crawford, Greene and Sac counties).

The fourth section of the report outlines potential economic development strategies communities and regions could consider as part of their economic development efforts to foster and develop industry clusters. The final section of the report provides concluding remarks and suggestions for economic development policy makers in Iowa to consider if cluster-based economic development becomes the focal point in Iowa.

Overview of Industry Clusters

What Are Industry Clusters?

"Industry clusters" are currently one of the popular concepts and strategies in economic development. It seems everyone, from the media to economic development professionals to elected officials, is talking about industry clusters and how cluster-based economic development is the cure to a state or region's economic ills. Public policy and economic development efforts at the state, regional and local levels are being shaped around industry clusters. Often, terms such as industry clusters, agglomeration, business networks and industrial districts get tossed about and often used interchangeably as clusters are discussed. But what is an industry cluster? What constitutes the existence of an industry cluster in a region or state? Why do industries cluster? How are industry clusters identified? All of these questions are discussed in this section. In addition, the critical factors impacting the growth and decline of industry clusters are discussed.

A review of the academic and economic development practitioner literature turns up a variety of definitions of industry clusters. This can create confusion when attempting to understand the industry cluster concept and apply it to the real world. Much of the literature on industry clusters is cast either from theoretical and analytical perspectives (to understand and explain clusters) or from a policy perspective (to explain how industry clusters can be utilized to promote economic growth).

Table 1: Definitions of Industry Clusters

A **cluster** is a geographically bounded concentration of similar, related or complementary businesses with active channels for business transactions, communications, and dialogue, that share specialized infrastructure, labor markets and services, and that are faced with common opportunities and threats. – National Governors Association, *A Governor's Guide to Cluster-Based Economic Development,* p 9. (2002)

An **industry cluster** may be defined as a group of business enterprises and non-business organizations for which membership within the group is an important element of each member firm's individual competitiveness. – Edward M. Bergman and Edward J. Feser, *Industrial and Regional Clusters: Concepts and Comparative Applications,* p. 2 (1999)

A **cluster** is a geographically proximate group of companies and associated institutions in a particular field, linked by commonalities and complementarities. – Michael E. Porter, *On Competition*, p. 199 (1998)

A **cluster** … [is] a large group of firms in related industries at a particular location. – G.M. Peter Swann and Martha Prevezer, in *The Dynamics of Industrial Clustering: International Comparisons in Computing and Biotechnology,* p. 1 (1998)

Industry clusters are agglomerations of competing and collaborating industries in a region networked into horizontal and vertical relationships, involving strong common buyer-supplier linkages and relying on a shared foundation of specialized economic institutions. – James O. Gollub, *Cluster-Based Economic Development: A Key to Regional Competitiveness,* p. 2 (1997)

An **industrial cluster** is a set of industries related through buyer-supplier and supplier-buyer relationships, or by common technologies, common buyers or distribution channels or common labor pools. A regional cluster is an industrial cluster in which member firms are in close geographic proximity to each other. – Michael J. Enright, *Regional Clusters and Economic Development: A Research Agenda,* p. 191 (1996)

Table 1 provides a sampling of definitions of industry clusters pulled from various sources. Several themes or key concepts are represented among these definitions and are evident throughout much of the cluster literature. These include regional interaction between firms, geographic proximity, buyer-supplier relationships, commonality of labor markets, technologies and support services.

Rather than using a succinct, formal definition for an "industry cluster," it is more practical to highlight some of the typical key characteristics of industry clusters that will enable a broader understanding. An examination of the reasons why clusters develop and grow and the benefits businesses receive from clustering helps to outline these characteristics.

Any discussion of the reasons for the formation of clusters and the benefits derived from clusters typically begins with firm and region competitiveness. Attention to industry clusters as an economic development strategy was spurred by the release of *The Competitive Advantage of Nations* by Michael E. Porter in 1990. Porter's research has focused on the competitiveness of firms, nations and regions. Most academic and applied research work on clusters since 1990 begin with an overview of Porter's thesis on clusters and regional competitiveness, so a detailed review is not provided in this report (see Martin and Sunley, 2003; Feser, 1998; Doeringer and Terkla, 1996; Rosenfeld, 1995). It is important, however, to cover Porter's basic concept since it has shaped much of the discussions related to cluster-based economic development.

In *The Competitive Advantage of Nations* and subsequent research, Porter states that four key aspects of the business environment interact together to determine the competitive advantage of a region or nation. These four drivers of competitiveness are:

- Factor market conditions – these are factors of production such as natural resources, available labor (skilled and unskilled), available land, capital and scientific and technology infrastructure.
- Firm structure and rivalry – these are factors such as the context in which firms are created, organized and managed, the degree of local, regional and national competition among firms, the cultural and historical factors affecting how companies do business with each other, their workers and other institutions such as government.
- Demand conditions – these are factors related to the nature and scale of product demand at the local, regional, national and international levels.
- Presence of related and supporting industries – these factors relate to proximity of suppliers and successful competitors that help to foster a competitive environment, as well as inter- and intra-industry cooperation, both of which help to lead to great innovation (Porter, 1990).

According to Porter, the success of any firm, industry, region or nation is based on these four factors and their interaction. Therefore, the clustering of industries provides for a competitive advantage for the industries and the firms within those industries by allowing them to benefit from the factor conditions and to improve and expand the factor conditions. A challenge with applying Porter's ideas at a local or regional level is determining the degree of cluster presence of the factor conditions influencing a cluster or clusters. Some factor conditions are easily

identified and measured, such as available physical infrastructure, while others, such as the competitiveness of a firm or industry, are more difficult to identify or measure.

Within Porter's four factor conditions, or drivers of competitiveness, can be found many individual functional reasons for cluster formation and benefits derived from clusters. An examination of the more widely known regional clusters in the U.S. show that clusters have developed either naturally or by design. Examples of clusters that have developed naturally include Silicon Valley, Boston's Route 128, Detroit's automotive cluster and the hosiery cluster in North Carolina. These "spontaneous" clusters were developed over time, at least initially, by a series of autonomous location decisions and historical events. Obviously, public policy such as government spending on research and development and national defense have helped to shape and grow some of these clusters, particularly Silicon Valley and Route 128.

From a historical context, the automotive industry cluster in Michigan and beyond can point its origin to the fact that Henry Ford happened to be there and began the Ford Motor Company (Maggioni, 2002; Gollub, 1996). The same can be said of Silicon Valley's semiconductor cluster. William Shockley, one of the inventors of the transistor, founded his firm near Palo Alto and later went on to be on the faculty of Stanford University. Most of the early semiconductor firms in Silicon Valley had direct ties either to Shockley's firm or Fairchild Semiconductor. Fairchild Semiconductor was a start-up firm created by former scientists who worked for Shockley (Saxenian, 1994).

The Research Triangle in North Carolina, the computer-related cluster in Austin, and multiple clusters in Arizona are all examples of clusters developed or greatly expanded by design through strategic interventions and policy decisions. Some researchers have called these "artificial" clusters (Maggioni, 2002, p 21). Policy decisions have included the development of science industrial parks, business parks, or research and development innovation centers targeting specific industries. Planning and policy have created locational incentives or firm benefits that have helped an industry cluster to develop (Gollub & Waldhorn, 1996; Rosenfeld, 1995).

Why Industries Cluster and Benefits from Clustering

Whether an industry cluster has developed naturally or by design, economic efficiencies and cost factors are the ultimate driving force behind why industries cluster and individual firms decide on a specific location. A firm will locate in a regional cluster because it wants to benefit

from agglomeration economies, which can either be localization economies that are industry specific, or urbanization economies, that are non-industry specific. Within an industry, the clustering of firms can allow for greater production specialization by individual firms, the reduction of search costs for skilled labor, since labor is attracted to the region, or the reduction of transaction costs between firms in the industry. Examples of the benefits of urbanization economies include the access to specialized services such as testing firms, finance and venture capital firms, accounting firms or advertising and marketing firms, as well as the reduction of search costs for unskilled labor or the spread of knowledge and innovation across industries (Maggioni, 2002; Rosenfeld, 2002; National Governors Association, 2002).

Access to key inputs (supply) or the presence of a market (demand) are other reasons why firms cluster. The presence of local or regional supply chains allow for just-in-time delivery of products and inputs which helps to reduce transaction costs. The availability or quality of raw materials used in production is a benefit to clustered firms (Doeringer & Terkla, 1996). In addition, the existence of specialized or tailored infrastructure such as redundancy in fiber-optic information technology infrastructure or specialized waste-water treatment facilities can encourage firm clustering and provide significant benefits to firms.

Clustering often creates benefits from the presence of specialized services provided by firms, universities and colleges, or other institutions which can be readily accessed. A third-party provider might provide product and material testing, product engineering and design, customized training, legal expertise, export assistance, inventory management or environmental assistance (Rosenfeld, 1995; Maggioni, 2002; Porter, 1998b). The presence of a key technological expertise or service by a university or college will attract firms or foster the commercialization of technologies that lead to business start-ups. In other circumstances, the industry cluster presence has driven the technology and training specialization of colleges and universities or the provision of products and services by other firms. This has often led to the creation and growth of other industry clusters within a region, such as the software industry cluster in Silicon Valley, which was an outgrowth of the semiconductor and computer hardware clusters (Swann & Prevezer, 1998; Preverzer, 1998; Saxenian, 1994).

As mentioned previously, the availability of financial capital is an important reason why firms locate in a region. Successful industry clusters have access to financial capital through venture capital firms, angel investors and other sources of funding for initial start-ups from

entrepreneurial activities to large corporate expansions. Regions such as Silicon Valley, Route 128, Austin and the Research Triangle all have become centers for venture capital firms. In addition to providing risk capital, venture capitalists also play key roles in a cluster's growth and development by serving such functions as matchmaking, network development and business plan and strategy formulation.

Benefits from clustering also include the availability of specialized skilled and semi-skilled workers who are currently in a region's existing labor market or that will be entering the region's labor market through the training and educational systems in the region. In addition, the "thickness" of a region's job market due to the presence of industry clusters enables it to attract additional workers to the regional labor market (Florida, 2002). A cluster is able to achieve a critical mass of the skilled workers its industries need, which is likely to produce higher levels of productivity. Higher productivity typically leads to higher wages and increased incomes and wealth in the region. Worker mobility into and within a regional cluster also enhances the spread of new technologies and innovations within and across industries (Rosenfeld, 2002; Porter, 1998a; Maggioni, 2002).

As Porter (1998b), Rosenfeld (1995) and others have pointed out, another benefit of clustering is the dynamic of firm competition and cooperation. The presence of competitive firms within a cluster sparks the need for innovation by firms in an industry and by the firms that supply the industry. Pressures can also be placed on support firms and agencies to be innovative in their provision of services to the industry cluster. A college or university might be pressed to provide more flexible or advanced training or to structure its academic degree programs' curriculums to graduate students who are better qualified and prepared for employment in the industries within a cluster (Porter, 2000; Rosenfeld, 1995; Rosenfeld, 2002).

Access to markets is also an important reason why firms cluster. Some industry clusters are dominated by one or several key firms which can dictate where its suppliers and service provides are located. This is called a "hub-and-spoke cluster" (Markusen, 1996). Detroit, with the automotive industry, and Seattle, with the aerospace industry, are two good examples. To a lesser extent, an example is the farm equipment industry in Eastern Iowa. Firms locate within a region to sell their products or services to other firms. The expansion of outsourcing by corporations and the demand for just-in-time delivery has created market opportunities for firms but often limits their location decisions.

Industry clusters also develop and grow due to factors which are not as easy to measure or observe, and create benefits which are less tangible and are not as easily tied to the economics of an industry or individual firm. These are what Rosenfeld has called "soft benefits" (National Governors Association, 2002, p. 10). Many of these benefits are related to the flow of information and knowledge within a cluster both within and across industries. A firm within a cluster is often more flexible and able to meet a customer's needs due to better information and awareness. It is likely more in tune with industry trends. Firms are also more likely to be exposed to new and emerging technologies, trade practices, and production and process enhancements.

This access to knowledge, often called "knowledge spillovers," gives firms the flexibility and capability to respond quickly to market demands that can help firms and industries within a cluster remain competitive (Porter, 2000; Rosenfeld, 1995; Bergman & Feser, 1999). The dissemination of knowledge can either be explicit, codified knowledge, or informal, tacit knowledge. Codified knowledge is knowledge, information, or ideas that can be easily transferred regardless of distance using old or new technologies, such as a book or the Internet. Tacit knowledge is based on human experience and knowledge and can only be shared through close interaction, typically face-to-face. The geographic proximity that is provided through clustering helps to foster the flow of tacit knowledge between individuals and organizations. Proximity is therefore a strong influence in the degree of technology transfer and innovation between firms, organizations and individual workers. (Munnich, Schrock & Cook, 2002; Rallet & Torre 1998; Botkin & Seeley, 2001; Swann & Prevezer, 1998).

Clustering also creates benefits from the formal and informal collaboration and networking that is often present between firms within the same industry or in different industries, as well as with other organizations such as colleges and universities or research institutions and agencies. The increased specialization of firms often dictates the existence of these relationships in the production of a product. In many industry clusters there exists collaborative and competitive relationships between the same firms. This relationship has been termed "co-opetition" by Brandenburger and Nalebuff (1997). An example of this relationship is Dell Computers and Compaq Computer competing for computer sales while collaborating with each other to defray Intel research and development costs for semiconductor development (Brandenburger & Nalebuff, 1997). Rosenfeld provides several examples of this type of

relationship in the hosiery industry cluster in North Carolina where competing firms will often assist each other with production runs in order to fulfill a customer's order. Another example is the development of furniture showroom space in Tupelo, Mississippi by the local firms and community organizations that attract furniture buyers (Rosenfeld, 1995).

These interactions and relationships also allow for collaboration on addressing issues that might cut across industries within a region, such as workforce development needs or the lack of affordable housing. Often referred to as social capital, these relationships help create trust that can be used to solve problems. Greater civic involvement is also fostered through the presence of trust and social capital. Broad community and regional issues are able to be addressed that might relate to the environment or quality of life of a community or region (Rosenfeld, 2002; Temple, 1998).

Life Cycle of Industry Clusters

It is important to understand that industry clusters are dependent upon the economic success of individual industries and firms and that an industry cluster is not isolated from the broader regional, national and global economies. Also, an industry cluster has a life cycle or development path, from initial development to periods of sustained growth and then to maturity (Magginoni, 2002; Rosenfeld, 2002). A region becomes attractive to both firms and workers as a cluster begins to grow and exert economic influence in the broader economy. As mentioned above, the benefits of clustering help to reinforce or strengthen the cluster's draw or attraction.

At a certain point, the benefits of clustering can start to decline or even become disadvantageous. The concentration of firms may become so large and competition so severe that product supply outstrips demand. Within the region the costs of labor, land, housing or production inputs will escalate when they are in short supply. These factors can impact an industry directly or indirectly. The direct impacts are obvious including wage inflation, high land costs and labor shortages. An example of an indirect impact is the rising cost of housing in a community or region. A shortage of affordable housing can impact a community's quality of life since, for example, public sector employees, such as fire fighters and teachers, will have difficulty finding affordable housing in the community, which in turn may cause a labor shortage for public service jobs. The school district may have to increase the number of students in classes and the fire department may have to limit fire services due to low staffing. Such conditions make a region unattractive for companies or individuals.

Industry clusters have also experienced decline or even death due to changes in technology, market conditions, or consumer demand. One historical example is the textile industry cluster in Massachusetts in the nineteenth century where advances in technology and mass production changed how textiles were produced. Another example is the decline of Boston's Route 128 during the 1980s and early 1990s when the personal computer overtook the mini-computer and companies like Apple, Dell, Gateway and Compaq replaced Route 128 companies such as Wang, DEC and Data General (Saxenian, 1994).

Some industry clusters, just like individual firms or industries, are able to adjust or shift focus to sustain their economic viability. This is often done by the development of new industries within the cluster or the development of new products within key industries. An example of this is the growth of the software industry and the computer peripherals industry in Silicon Valley that grew out of the computer hardware and semiconductor industries. Another example of this process of convergence between multiple industries or technologies is the multimedia industry, which grew out of the interaction between the telecommunications and information technology industry and the computer and electronics industries (Swann, 1998; Maggioni, 2002). Technology and the new application of technology have helped to create new markets and demand for existing industries or create new industries within a cluster.

Identifying Industry Clusters

Challenges

One of the major challenges surrounding industry clusters and cluster-based economic development is determining what exactly encompasses an industry cluster and the interaction between firms and other key organizations in a region. Martin and Sunley (2003) point out that there is no standard method or technique for identifying the make-up and geography of industry clusters. A review of the literature and various cluster studies shows that some researchers use narrow definitions and measures for identifying the presence of clustering among firms while others use looser definitions and measures. With this diversity of measures and techniques, researchers have identified and focused on regions with one to many clusters. SRI International identified three broad clusters for the state of Iowa: advanced manufacturing, life sciences and information solutions (SRI, 2000). Porter (2003) has identified 40 "traded clusters" which have a presence in the United States. Feser and Koo (2001) identify 28 value-chain clusters, 8 technology clusters and 17 labor skills clusters. DRI/McGraw Hill (Gollub, 1996a) identified

380 regional industry clusters in the U.S. that consist of 19 types of clusters that were grouped into four broad categories.

Like the benefits to firms from clusters, it might be appropriate to divide the potential evidence or measures of firm clustering into "hard" and "soft" evidence, or quantitative and qualitative measures. A comprehensive regional cluster strategy should be based on both qualitative and quantitative research. Hard measures can include industry employment, the number of establishments, inter-industry and intra-industry sales data and proximity of suppliers. Soft measures might include the intensity and patterns of communication and knowledge spillover between firms and workers within and across industries, workforce skills, the availability of capital, access to specialized services, the intensity of firm competition, social infrastructure and entrepreneurial activity (Rosefeld, et al, 2000; Porter, 1998; Doeringer & Terkla, 1996; Rosenfeld, 1995). All of these hard and soft measures provide characteristics that help determine the presence of and potential for industry clusters.

Obtaining useable data or information, either hard or soft, can be expensive and time consuming. A common starting point is government data from state and federal agencies. Data on firms has limitations since it is identified and segmented by industry classifications, either under the U.S. Standard Industrial Classification (SIC) system or the North American Industry Classification Systems (NAICS), which is replacing the SIC system. SIC/NAICS groups firms into industries based on what they produce and does not reflect the commonality of firms and industry groupings based on shared technologies, resource usage, or labor skills. Data based on these industry classification systems also does not reflect industries that are emerging. In addition, some industry categories are quite broad making them less useful for the cluster analysis. The implementation of the NAICS system will help to address this to a great extent (Cortright & Reamer, 1998; Rosenfeld, 1995).

Another limitation with government data, and most data, is that it represents a snapshot of one point in time and not trends or dynamic conditions over time. There is often a considerable time lag from when the data is collected to when it is released (Cortright & Reamer, 1998). Geography is also a concern with government data since the data is based on political boundaries that typically do not reflect the boundaries of a regional economy. Another issue with relating to geography and government data is that as the geographical region gets smaller, a smaller amount of data is available. This can occur either because it is not collected or because it cannot be

released due to government data suppression restrictions. These restrictions are in place to protect the identity of the firms or individuals who are being portrayed by the data.

The most common data challenge is the lack of available data. Much of the information that would be useful in determining if there is clustering happening in a region is not readily available or is very expensive to collect or access. One of the best approaches for measuring the economic interaction between firms within industries and across industries is sales data on whom a firm sells to and from whom a firm buys (Maggioni, 2002).

Methods

As discussed above, researchers use a range of methods and techniques to identify industry clusters using hard and soft measures. Many studies use location quotients as a quantitative method to measure the presence of clusters since the data to calculate location quotients is readily available. A location quotient measures the share of employment a region has in an industry or cluster compared to some other region, usually taken to be the national share. If an industry or cluster has a location quotient equal to 1.0 that means that a region's share of employment within that industry or cluster is the same as that industry or cluster's employment share in the comparison region. Location quotients greater than 1.0 typically imply industries that export their product outside of the local region while industries with location quotients less than 1.0 imply industries where products are typically imported. There are, of course, exceptions to this rule and problems with this measure, but for a quick measure of importing and exporting industries the location quotient is standard. Location quotients are limited since they do not provide any information about the presence of buyer/supplier linkages in a region (Martin & Sunley, 2003; Bergman & Feser, 1999; Rosenfeld, 1995).

Firm surveys, interviews and focus groups are all examples of qualitative approaches used by researchers to identify clusters. Information is gathered from industry leaders, public officials and experts from support organizations and businesses, such as venture capitalists, university faculty and workforce development specialists. Gathering this information based on expert opinion requires a tremendous amount of time and resources. Information based on the opinions and observations of individuals can often be biased or narrowly based on the respondent's role and experience in the region. Another challenge is shaping opinions gathered into data which can be used for detailed analysis. This requires a tremendous amount of time as well as an objective mindset to remove the researcher's biases (Martin & Sunley, 2003; Bergman

& Feser, 1999; Rosenfeld, 1995). Despite these challenges and the required resources, these qualitative methods often provide insights into the social networks, the flow of ideas and knowledge, and the innovative environment within a region and within and across clusters.

A more advanced quantitative approach that is used in identifying the existence of a cluster are input-output models which depict the purchasing patterns between businesses. Input-output analysis allows for a greater understanding of linkages between industries. The clusters that are identified through the use of input-output models are often called "value-chain" clusters. Input-output data can be obtained at a regional, state and national level, yet the input-output data at the smaller geographic-level provides some limitations since it only focuses on industries within the region and does not include suppliers or buyers outside the region (Bergman & Feser, 1999). As mentioned earlier, the collection of actual sales data from firms in a region would be ideal in understanding buyer-supplier relationships, but it is not likely to be achieved, so input-output data helps to fill that gap.

Benchmark Industry Cluster Framework

It is from an input-output model approach that this report examines industry clusters in Iowa. After reviewing various methods outlined in the literature on identifying industry clusters, it was determined that a national industry cluster template framework initially developed by Edward J. Feser at the University of North Carolina and Edward M. Bergman at the University of Austria and then enhanced and expanded by Feser and Koo (2001) could be replicated for regions in Iowa.

In their initial analysis, Feser and Bergman identified 28 "benchmark value-chain clusters" by conducting a statistical analysis of the *Benchmark Input-Output Accounts of the United States* to identify the trading patterns and technological similarities between industry sectors (see Feser & Bergman, 2000). Value-chain clusters are groups of industries in similar product chains, such as final market producers and their suppliers, or for non-manufacturing industries, groups of industries that utilize similar labor pools, such as banking and advertising. Feser enhanced the benchmark value-chain clusters by expanding the statistical analysis to include the *U.S. Staffing Patterns Matrix* and detailed occupational characteristics data from the U.S. Department of Labor, which led to the additional identification of eight "technology value-chain clusters" focusing on high-tech businesses.

Feser and Koo (2001) also identified 17 "benchmark labor clusters" by analyzing the *Staff Patterns Matrix* along with data from the Occupational Information Network (ONET), which is a matrix that identifies the knowledge and skills required for over 1,100 occupations. The benchmark labor skills ranged from "low skill, non-durable manufacturing" to "information processing" to "health services." Each benchmark labor cluster consists of industries which have similar labor skill demands.

The advantage of using this framework is that the benchmark value-chain clusters and benchmark technology clusters provide a set of industry clusters based on buyer-supplier linkages of industries, and the benchmark labor clusters provide a set of industry clusters based on the utilization of similar workforce skills by industries. For each of the three cluster templates the industries within each cluster are identified at the four-digit Standard Industry Code (SIC) classification (see Appendix A).

The benchmark value-chain clusters and the benchmark technology clusters were compared with the three broad clusters that were identified by SRI International in *Iowa Target Industry Cluster Analysis* (IDED, 2003). The comparison shows that the industries which SRI International identified as components of Iowa's advanced manufacturing, information solutions and life science clusters significantly mirror the industries that make up the benchmark value-chain clusters and the benchmark technology clusters. An example is that the life sciences cluster identified by SRI International shares multiple industries with seven of the benchmark value-chain clusters, including the packaged food products industry cluster, the pharmaceuticals industry cluster and the chemicals and plastics industry cluster. An appropriate way of looking at the two typologies is that the clusters identified by SRI International provide macro-level analysis while the benchmark cluster framework provides micro-level analysis. As mentioned above, an advantage of the benchmark cluster framework utilized in this report is that it identifies the specific industries at the four-digit SIC code classification, which have buyer-supplier relationships or commonalities of workforce or technology.

Applying the Benchmark Cluster Framework to Iowa

Data for Analysis

To apply the cluster template framework and conduct regional cluster analysis for Iowa and the three pilot regions, IDM acquired U.S., state and county level employment and wage data at the 4-digit SIC Code level. This information was collected through the Minnesota

IMPLAN Group (MIG) since there was no available government data for many industry sectors at these levels due to federal data suppression requirements to protect the identity of businesses. MIG uses statistical modeling to estimate employment and wages for all industries present within a specific state and county. In order to examine cluster trends, data for 1990 and 2000, the latest data available, were obtained for this analysis.

The IMPLAN data were then aggregated into the various benchmark value-chain clusters, technology benchmark clusters and benchmark labor clusters to determine the level of cluster presence in the region. What follows is an analysis of that data for Iowa to determine potential cluster presence and a comparison of the state's clusters with those clusters at the U.S. level. An overview of the results from the analysis completed for the three pilot regions is also provided.

Benchmark Value-Chain Clusters

As described, the 28 benchmark value-chain clusters are based on buyer and supplier linkages of various industries. Table 2 provides a breakdown of employment and average wages of the benchmark value-chain clusters in Iowa. The table is sorted by total employment in the year 2000. The metalworking and industrial machinery industry cluster had the highest employment in 2000 with over 96,000 employees. The hospitals, labs and specialized medical services industry cluster had the second highest level of employment in Iowa with 68,597, followed by the printing and publishing industry cluster with 57,768.

Of the 27 value-chain clusters having a presence in Iowa, 15 clusters experienced growth in employment from 1990 to 2000. Another three clusters experienced no employment growth from 1990 to 2000. Nine clusters experienced a decline in employment from 1990 to 2000. At the national level for the same timeframe, for the same 27 clusters, 16 clusters experienced employment growth while 11 clusters experienced a decline in employment. However, nearly half of the clusters present in Iowa had employment trends which did not mirror U.S. trends. Five of the value-chain clusters in Iowa either grew or remained level in employment while those same clusters declined at the national level. Four of the clusters experienced increases in employment at the national level while in Iowa the clusters had employment declines.

Location quotients are a useful analytical tool to compare the economic base of a region or state to other regions or states. A location quotient measures the "share" a region or state has of an industry or cluster compared to the other regions or states in the United States. If an industry or cluster has a location quotient equal to 1.0 that means that a region or state's

employment within that industry or cluster is relatively proportional to that industry or cluster's employment at the national level. Location quotients greater than 1.0 typically imply industries that export their product outside of the local region while industries with location quotients less than 1.0 imply industries where products must be imported. There are, of course, exceptions to this rule and problems with this measure, but for a quick measure of importing and exporting industries the location quotient is frequently used.

Table 2: Employment Change and Location Quotients

Cluster	Employment				
		% Change		Location Quotients	
	IA 2000	IA '90-'00	US '90-'00	IA 2000	IA '90-'00
Metalworking and industrial machinery	96,426	-0.1%	0.6%	1.67	0.19
Hospitals, labs, and specialized medical services	68,597	0.3%	3.5%	0.82	-0.12
Printing and publishing	57,768	0.2%	3.4%	0.93	-0.12
Construction materials	43,019	0.3%	1.2%	1.11	0.11
Packaged food products	42,419	-0.1%	0.1%	2.33	0.35
Transportation, shipping, and logistics	40,278	0.2%	2.8%	1.06	-0.08
Motor vehicle manufacturing	37,984	0.0%	1.4%	1.16	0.05
Banking and advertising	36,245	0.1%	1.2%	0.91	0.07
Information technology and instruments	35,298	0.0%	2.7%	0.68	-0.06
Chemicals and plastics	29,552	0.1%	1.2%	0.97	0.08
Securities and insurance	25,415	0.3%	2.1%	1.25	0.01
Wood products and furniture	14,909	0.7%	0.6%	1.32	0.23
Aerospace	10,953	-0.2%	-5.1%	1.35	0.67
Canned and bottled beverages	9,244	-0.4%	-1.6%	4.37	1.14
Fabricated textiles	7,737	0.0%	-3.5%	0.63	0.26
Primary nonferrous metals	7,362	0.3%	0.8%	1.16	0.15
Legal services	6,556	-0.1%	1.0%	0.59	0.05
Stone, clay, and glass products	4,005	-1.7%	-1.3%	1.24	0.16
Aluminum	3,711	0.2%	-2.9%	1.90	0.74
Apparel	3,088	-1.1%	-4.6%	0.28	0.12
Pharmaceuticals	2,245	0.3%	2.7%	0.65	-0.04
Boat building	1,559	-1.9%	0.3%	0.68	-0.03
Food oil mills	1,463	0.3%	-1.0%	4.65	1.24
Platemaking and typesetting	1,208	0.1%	-1.8%	1.27	0.40
Petroleum products	519	0.9%	-2.1%	0.36	0.14
Leather goods	401	-0.3%	-6.7%	0.59	0.34
Jewelry	18	1.2%	-2.4%	0.03	0.01

(Tobacco products cluster has been left out)

Table 2 provides the location quotients for all of the value-chain industry clusters present in Iowa. Fourteen of the value-chain clusters in Iowa had a location quotient greater than 1.0. Two industry clusters had location quotients above 4.0: food oil mills industry cluster (4.65) and canned and bottled beverages industry cluster (4.37).

Table 3: Benchmark Value-Chain Clusters
Employment and Average Wages

Cluster	Employment				Average Wage		
			% Change			% Change	
	2000	Per Estab.	IA '90-'00	US '90-'00	2000	IA '90-'00	US '90-'00
Metalworking and industrial machinery	96,426	60.8	-0.1%	0.6%	38,880	0.4%	4.1%
Hospitals, labs, and specialized medical services	68,597	24.7	0.3%	3.5%	31,073	0.6%	8.1%
Printing and publishing	57,768	19.3	0.2%	3.4%	37,632	0.7%	8.7%
Construction materials	43,019	31.7	0.3%	1.2%	35,300	0.4%	5.1%
Packaged food products	42,419	123.7	-0.1%	0.1%	31,559	0.3%	4.2%
Transportation, shipping, and logistics	40,278	11.1	0.2%	2.8%	30,482	0.4%	3.4%
Motor vehicle manufacturing	37,984	79.1	0.0%	1.4%	34,284	0.5%	4.6%
Banking and advertising	36,245	12.6	0.1%	1.2%	37,860	0.6%	10.3%
Information technology and instruments	35,298	22.0	0.0%	2.7%	41,180	0.6%	10.2%
Chemicals and plastics	29,552	20.9	0.1%	1.2%	34,938	0.6%	4.1%
Securities and insurance	25,415	14.9	0.3%	2.1%	44,206	0.5%	8.1%
Wood products and furniture	14,909	46.4	0.7%	0.6%	29,901	0.4%	3.5%
Aerospace	10,953	405.7	-0.2%	-5.1%	49,278	0.4%	5.2%
Canned and bottled beverages	9,244	39.3	-0.4%	-1.6%	48,304	0.5%	6.2%
Fabricated textiles	7,737	36.5	0.0%	-3.5%	26,255	0.2%	5.9%
Primary nonferrous metals	7,362	27.8	0.3%	0.8%	31,683	0.1%	4.0%
Legal services	6,556	4.0	-0.1%	1.0%	38,958	0.9%	5.0%
Stone, clay, and glass products	4,005	59.8	-1.7%	-1.3%	49,239	0.4%	4.4%
Aluminum	3,711	265.1	0.2%	-2.9%	60,681	0.3%	4.0%
Apparel	3,088	34.7	-1.1%	-4.6%	22,237	0.1%	5.3%
Pharmaceuticals	2,245	53.5	0.3%	2.7%	37,801	0.6%	4.3%
Boat building	1,559	34.6	-1.9%	0.3%	55,490	2.0%	4.0%
Food oil mills	1,463	34.0	0.3%	-1.0%	37,655	0.4%	4.1%
Platemaking and typesetting	1,208	29.5	0.1%	-1.8%	45,120	1.1%	10.2%
Petroleum products	519	22.6	0.9%	-2.1%	35,283	0.1%	5.3%
Leather goods	401	17.4	-0.3%	-6.7%	26,595	0.4%	6.6%
Jewelry	18	2.6	1.2%	-2.4%	19,477	0.2%	6.8%

(Tobacco products cluster has been left out)

Table 3 provides employment and wage data for Iowa's value-chain clusters and compares the percentage changes in employment and average annual wage rates for Iowa and the United States. Table 4 compares wage data for each of the clusters at the national level and the state level for 1990 and 2000. The aluminum cluster had the highest average wage ($60,681) in 2000 in Iowa. All of the value-chain clusters in Iowa, and at the U.S. level, experienced an increase in their annual average wage from 1990 to 2000. The boat building industry cluster and the platemaking and typesetting industry cluster were the only two value-chain clusters in Iowa that had an annual average percentage increase over 1.0, while all of the clusters at the U.S. level had an annual percentage growth rate above 3 percent, with the

highest annual percentage being 10.3 percent for the banking and advertising cluster and the lowest being 3.5 percent for the wood products and furniture cluster.

Table 4 also shows that only three of the value-chain clusters in Iowa in 2000 had an annual wage higher than the cluster's national average. The composition of the industries within each cluster have a significant impact on employment and wage levels of that cluster. For many of the clusters, several key industries have a dominant influence on the cluster's make-up at the regional and state levels. The following sections provide a more detailed analysis of the five benchmark value-chain clusters having the largest employment in Iowa in 2000: metalworking and industrial machinery industry cluster, hospitals, labs, and specialized medical services industry cluster, printing and publishing industry cluster, construction materials industry cluster and the packaged food products industry cluster.

Table 4: Benchmark Value-Chain Clusters
Average Wages – U.S. and Iowa

Cluster	U.S. Average Wage		%Chg	Iowa Average Wage		%Chg
	1990	2000	'90-'00	1990	2000	'90-'00
Metalworking and industrial machinery	29,114	41,192	4.1%	37,261	38,880	0.4%
Hospitals, labs, and specialized medical srvs	26,639	48,194	8.1%	29,221	31,073	0.6%
Printing and publishing	31,867	59,668	8.7%	35,207	37,632	0.7%
Construction materials	28,703	43,416	5.1%	33,873	35,300	0.4%
Packaged food products	24,283	34,361	4.2%	30,665	31,559	0.3%
Transportation, shipping, and logistics	27,515	36,805	3.4%	29,386	30,482	0.4%
Motor vehicle manufacturing	30,082	43,859	4.6%	32,758	34,284	0.5%
Banking and advertising	30,759	62,451	10.3%	35,754	37,860	0.6%
Information technology and instruments	36,003	72,579	10.2%	38,959	41,180	0.6%
Chemicals and plastics	29,979	42,372	4.1%	32,930	34,938	0.6%
Securities and insurance	29,722	53,939	8.1%	42,045	44,206	0.5%
Wood products and furniture	24,879	33,692	3.5%	28,780	29,901	0.4%
Aerospace	39,302	59,570	5.2%	47,569	49,278	0.4%
Canned and bottled beverages	33,613	54,468	6.2%	45,778	48,304	0.5%
Fabricated textiles	17,729	28,165	5.9%	25,753	26,255	0.2%
Primary nonferrous metals	27,708	38,688	4.0%	31,261	31,683	0.1%
Legal services	39,997	59,969	5.0%	35,727	38,958	0.9%
Stone, clay, and glass products	37,168	53,442	4.4%	47,193	49,239	0.4%
Aluminum	38,195	53,580	4.0%	59,012	60,681	0.3%
Apparel	17,841	27,364	5.3%	22,061	22,237	0.1%
Pharmaceuticals	24,349	34,935	4.3%	40,565	45,120	1.1%
Boat building	31,395	43,837	4.0%	45,445	55,490	2.0%
Food oil mills	29,395	41,474	4.1%	36,039	37,655	0.4%
Platemaking and typesetting	43,202	87,128	10.2%	35,500	37,801	0.6%
Petroleum products	42,659	65,121	5.3%	34,827	35,283	0.1%
Leather goods	40,054	66,364	6.6%	25,493	26,595	0.4%
Jewelry	17,439	29,344	6.8%	19,013	19,477	0.2%

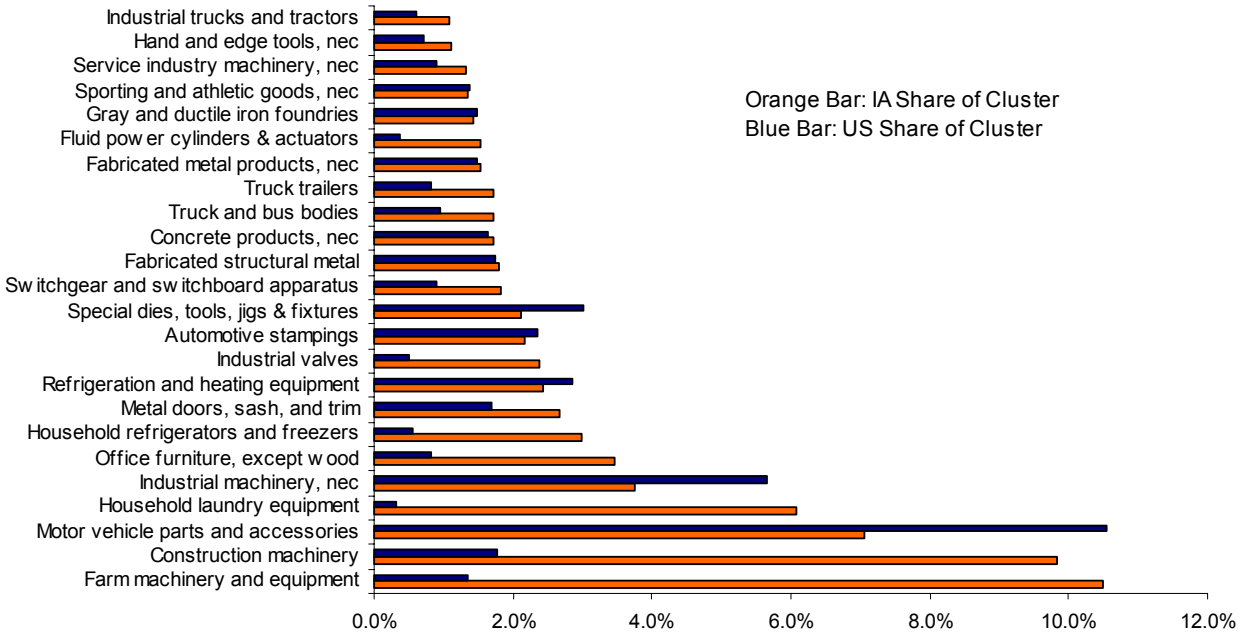
(Tobacco products cluster has been left out)

Metalworking and Industrial Machinery Cluster

The metalworking and industrial machinery cluster in Iowa had 96,426 employees in 2000 in more than 1,500 establishments with an annual payroll more than $3.7 billion. The cluster's average annual wage was $38,880. The cluster experienced an annual percentage wage increase of 0.4 percent between 1990 and 2000. The cluster's average at the U.S. level in 2000 was $41,192, with an average annual growth rate of more 3.5 percent 1990-2000. Employment in the cluster in Iowa declined by 0.1 percent annually from 1990 to 2000. At the U.S. level, employment grew annually 0.6 percent from 1990 to 2000.

Figure 1 shows the farm machinery and equipment industry (SIC 3523) and the construction machinery industry (SIC 3531) were the largest employers in the metalworking and industrial machinery cluster in Iowa. Other major employing industries were the motor vehicle parts and accessories industry (SIC 3714), the household laundry equipment industry (SIC 3633) and the industrial machinery, n.e.c. industry (SIC 3599). The largest employers in the cluster at the national level were the motor vehicle parts industry (SIC 3714), the industrial machinery industry (SIC 3599), the special dies, tools, jigs and fixtures industry (SIC 3544) and the blast furnace and steel mills industry (SIC 3312).

Figure 1 - Metalworking and Industrial Machinery Cluster Industry Mix

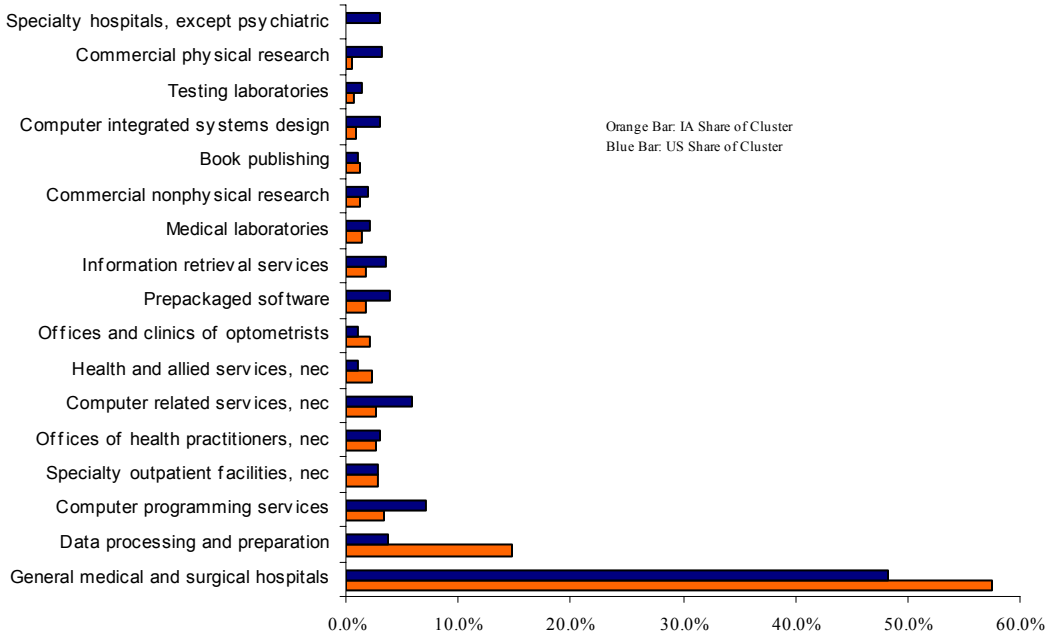


According to Iowa Workforce Development (IWD) the largest employers in Iowa in the metalworking and industrial machinery cluster include Maytag, Frigidaire, Vermeer Manufacturing, the HON Company, Fisher Controls, Assa Abloy Door Group (Curries), Lennox Manufacturing and Case Corporation.

Hospitals, Labs and Specialized Medical Services Cluster

As Figure 2 shows, the hospitals, labs and specialized medical services cluster is dominated both at the U.S. level and in Iowa by general medical and surgical hospitals (SIC 8062). This industry has 57.4 percent of the cluster's employment in Iowa, while it has just over 48 percent of the employment at the U.S. level. The second largest industry in this cluster in Iowa in 2000 was the data processing and preparation industry (SIC7374) with nearly 15 percent of the cluster's employment.

Figure 2 - Hospitals, Labs, and Specialized Medical Services Cluster Industry Mix



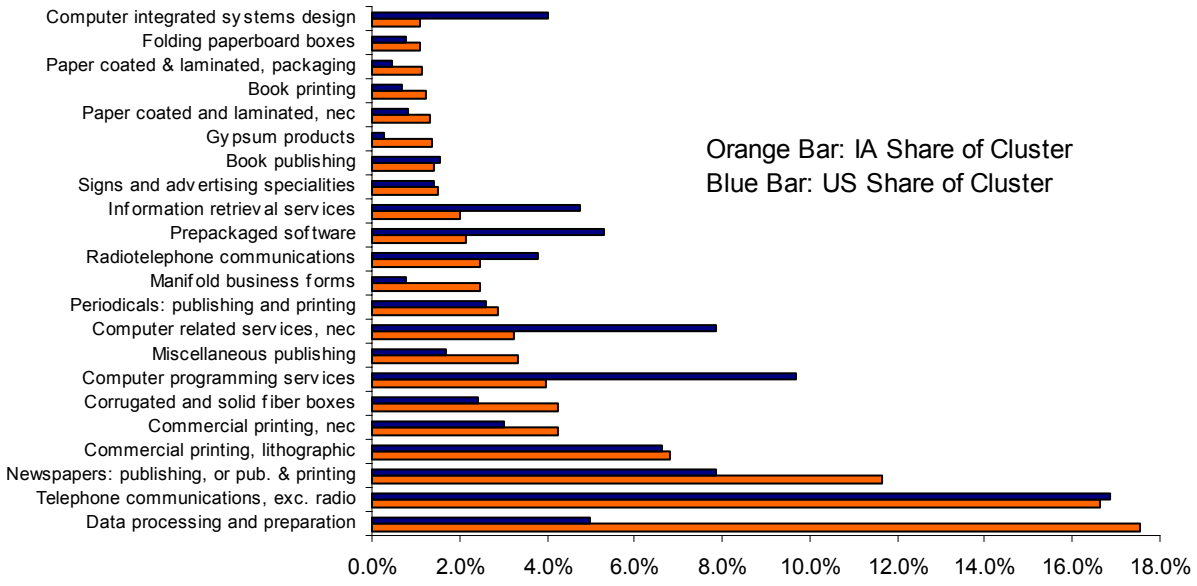
The average annual wage in 2000 for this cluster in Iowa ($31,073) is considerably below the national average wage ($48,194). The wage differences are even more dramatic for several of the industries that make up the cluster. The data processing and preparation industry had an annual average wage of $31,096 in Iowa and $53,997 at the U.S. level. The prepackaged software industry (SIC 7372) had an annual average wage of $40,397 in Iowa and $118,632 at

the U.S. level. Other industries with significant wage differences between Iowa and the U.S. include the information retrieval services industry (SIC 7379), the commercial non-physical research industry (SIC 8732) and the computer integrated systems design industry (SIC 7373). Once again the types of occupations within a given industry that are present in the region are very much a determining factor to wage levels offered in the region. The largest employers in the cluster are regional medical centers.

Printing and Publishing Apparel Cluster

The printing and publishing industry cluster had the third largest value-chain cluster in Iowa, employing 57,768 workers in 2000 with an annual payroll of nearly $2.8 billion. This cluster experienced employment growth between 1990 and 2000, if only 0.2 percent per year. At the national level the cluster grew at a rate of 3.4 percent per year. Figure 3 shows three industry sectors each had more than ten percent of the cluster's employment in Iowa in 2000.

Figure 3 - Printing and Publishing Cluster Industry Mix



The largest industry sector in this cluster in Iowa is the data processing and preparation industry (SIC 7374) with 17.6 percent of the cluster's employment followed by the telephone communications industry (SIC 4813) with 16.7 percent of the employment and the newspaper publishing industry (SIC 2711) with 11.6 percent of the employment. At the U.S. level the largest industry sectors were the telephone communications industry (SIC 4813), the computer

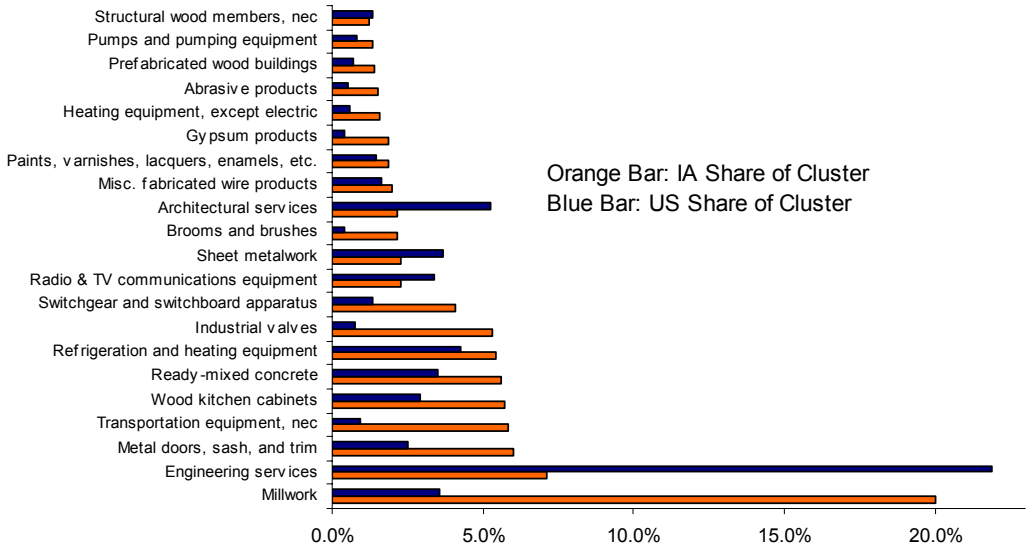
programming services industry (SIC 7371), the newspaper publishing industry (SIC 2711) and the prepackaged software industry (SIC 7372). According to Iowa Workforce Development (IWD), the major employers in this cluster in Iowa include Meredith Corporation, McLeod Publishing, Des Moines Register, Lee Enterprises, Gazette Communications and McGraw-Hill.

Wages in the printing and publishing industry cluster experienced growth both in Iowa and at the U.S. level. The annual average wage for the cluster in Iowa was $37,632 which was well below the U.S. average annual wage of $59,668. The cluster experienced an annual wage increase of more than 8 percent annually in the decade of the 1990s at the U.S. level while Iowa only experienced an annual increase of 0.7 percent. One of the major reasons for the wage difference is, at the U.S. level, computer related service industries pay high wages and have a larger percentage of the cluster's employment than in Iowa.

Construction Materials Cluster

Iowa's construction materials cluster had an employment level just over 43,000 in 2000, with 1,356 establishments and a payroll of more than $1.5 billion. The largest industry sector in the construction materials cluster in Iowa was the millwork industry (SIC 2431) with 20.0 percent of the cluster's employment. Other industry sectors with more than five percent of the cluster's employment include the engineering services (SIC 8711), the metal doors, sash and trim manufacturing (SIC 3442), the transportation equipment, n.e.c. (SIC 3799), the wood kitchen cabinets (SIC 2434), the ready-mix concrete (SIC 3273), refrigeration and heating equipment (SIC 3585) and the industrial valves SIC 3491). Figure 4 compares the employment distribution for the cluster in Iowa and nationwide.

Figure 4 - Construction Materials Cluster Industry Mix



At the national level, employment in this cluster is dominated by the engineering services (SIC 8711) and architectural services (SIC 8712) industries, followed by the refrigeration and heating equipment industry (SIC 3585), the saw mills and planing mills industry (SIC 2421) and the sheet metalwork industry (SIC 3444).

The average annual wage in 2000 for the cluster in Iowa was $35,300 compared to $43,416 at the U.S. level, a difference of more than $8,000. The significance of engineering and architectural services provides some explanation of the difference in the annual average wage in 2000 between Iowa and the U.S. for the cluster. According to IWD, the major employers in the construction material cluster in Iowa include Pella Corporation, Fisher Controls, Bertch Cabinet, Assa Abloy Door Group (Curries), Lennox Manufacturing, Omega Cabinets, Featherlite, and General Electric. It is important to recognize that an industry can be part of more than one industry cluster.

Packaged Food Products Cluster

Not surprisingly, the packaged food products cluster was one of the five largest value-chain clusters in Iowa based on employment in 2000 with 42,419 employees. The cluster's annual payroll was greater than $1.3 billion with an annual average wage of $31,559. The cluster's average wage increased by 0.3 percent annually between 1990 to 2000. The cluster's

average annual wage at the U.S. level was $34,361 in 2000 and had an annual percentage increase of 4.2 percent during the 1990s.

Figure 5 - Packaged Food Products Cluster Industry Mix

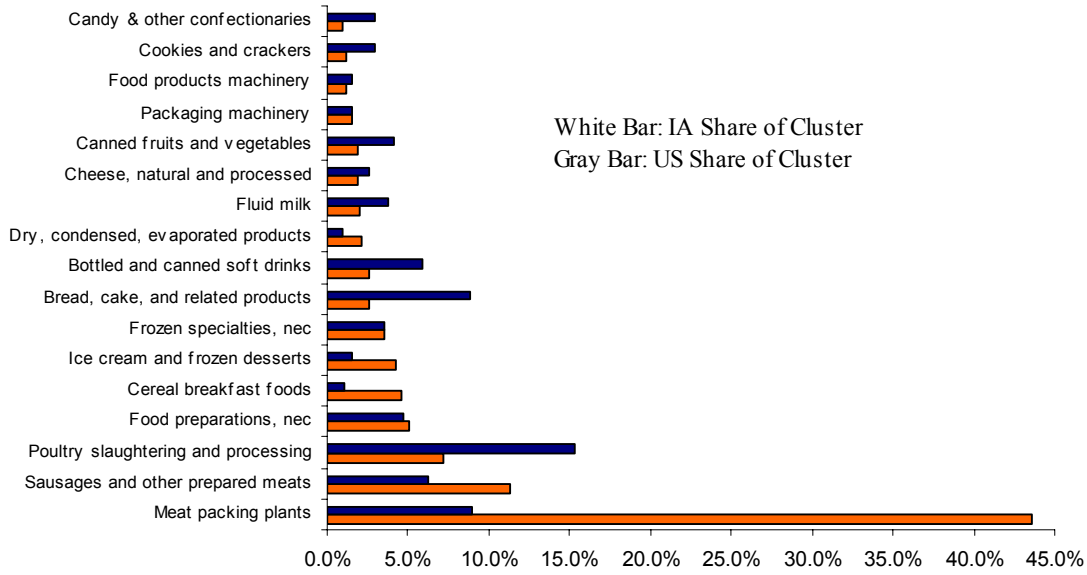


Figure 5 illustrates the distribution of employment by industry in the packaged food products cluster in Iowa and at the U.S. level. The meat packing industry (SIC 2011) comprised 43.6 percent of the cluster's employment in Iowa in 2000. The sausages and other prepared meats manufacturing industry (SIC 2013) was the next largest employer (11.3 percent of employment) followed by the poultry slaughtering and processing industry (SIC 2015) and the food preparations, n.e.c. industry (SIC 2099). The largest industry employers in the cluster at the national level are the poultry slaughtering and processing industry (SIC 2015), the bread, cake and related products industry (SIC 2051), meat packing industry (SIC 2011) and the sausages and other prepared meats manufacturing industry (SIC 2013). According to IWD, the largest employers in the packaged food products cluster in Iowa include IBP, Swift & Company, Excel Corporation, Wells Dairy, John Morrell, Farmland Foods, Quaker Oats, West Liberty Foods and H. J. Heinz Company.

Technology Benchmark Clusters

As explained above, the eight benchmark technology clusters that are identified in this research were derived from a statistical analysis of the interdependence among high-technology industries. It should be noted that these technology-intensive clusters are independent and not

simply sub-sets of the 28 benchmark value-chain industry clusters. Table 5 provides summary data about the technology clusters in Iowa and at the U.S. level. The analysis in this section illustrates that employment levels within the technology clusters ranges dramatically in Iowa. In some of the clusters several large employers anchor the clusters' presence in Iowa. In addition, the growth rates of the technology clusters at the U.S. level have considerably outstripped the clusters' growth in Iowa. In some cases clusters have grown nationally but have declined in Iowa. An illustration of these differences in growth rates can be seen in Figures 6 and 7 that compare each technology cluster's employment growth rates and employment size against average wages in 2000.

Figure 6 - U.S. Technology Value-Chain Cluster Trends

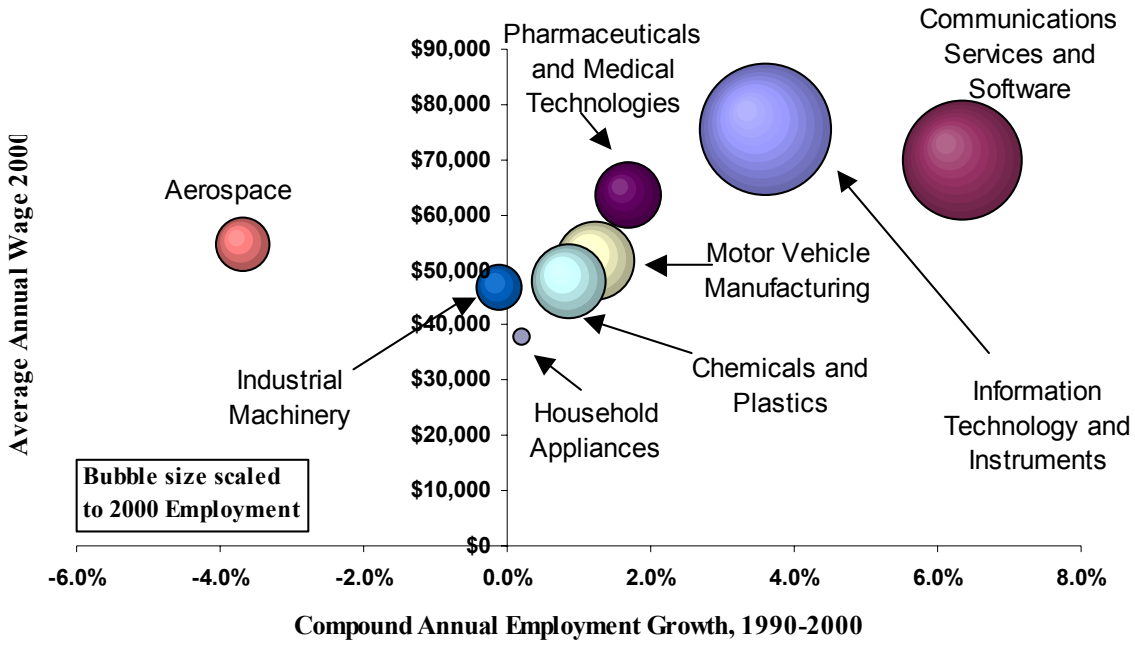
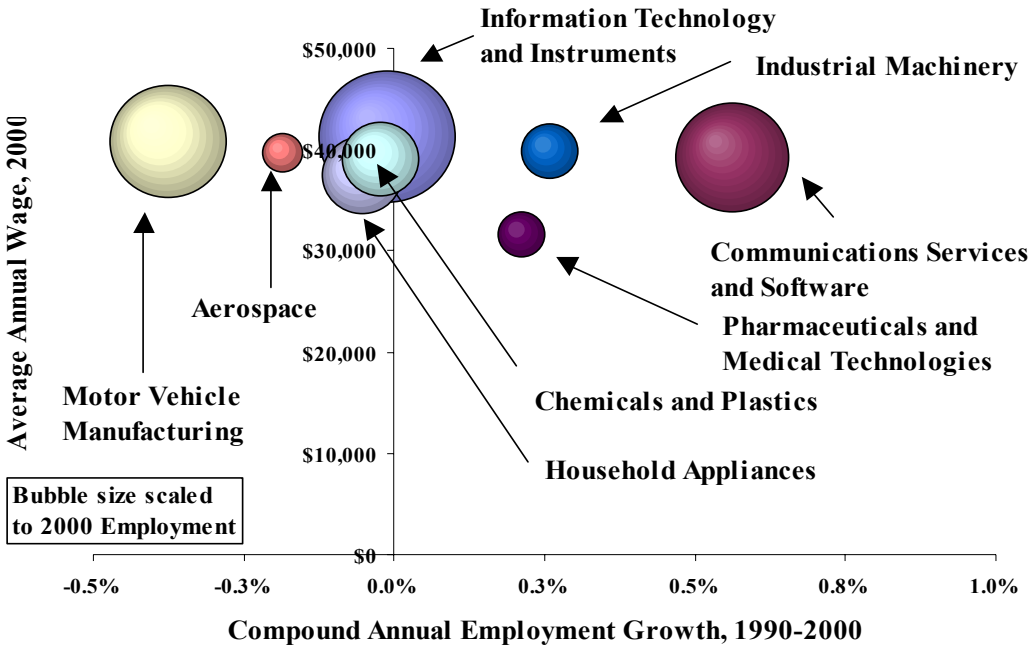


Figure 6 shows that at the U.S. level, the information technology and instruments technology cluster had the largest employment of the eight technology clusters. This technology cluster also had the highest annual average wage in 2000 for the U.S., $75,343 (see Table 5). For Iowa, the largest technology cluster was the information technology and instruments technology cluster, followed by the motor vehicle manufacturing technology cluster and the communication services and software technology cluster (see Figure 7).

Figure 7 - Iowa Technology Value-Chain Cluster Trends



At the U.S. level, all but two of the technology clusters experienced employment growth between 1990 and 2000, while only four of the clusters had employment growth during that same time. Five technology clusters in Iowa, either experienced employment growth or had minimal employment changes between 1990 and 2000.

Table 5: Iowa Benchmark Technology Clusters

	Employment								Payroll			
			CAGR		Location Quotient		Establish		Average Wage - 2000		*CAGR '90-'00*	
Description	2000	Per Estab.	IA '90-'00	US '90-'00	2000	Chg '90-'00	2000	CAGR '90-'00	Iowa	US	IA	US
Information Technology and Instruments	34,296	23.4	0.0%	3.6%	0.1	0.0	1,466	-0.9%	41,288	75,343	0.6%	7.7%
Motor Vehicle Manufacturing	24,634	107.6	-0.4%	1.2%	0.5	0.1	229	1.3%	40,755	51,561	0.4%	4.0%
Communications Services and Software	23,383	11.3	0.6%	6.3%	0.2	-0.1	2,077	0.0%	39,202	69,973	0.7%	6.5%
Household Appliances	12,034	1,203.4	-0.1%	0.2%	8.4	1.3	10	0.0%	37,511	37,861	-0.2%	3.6%
Chemicals and Plastics	10,849	18.7	0.0%	0.9%	0.3	-0.1	579	-2.2%	39,080	48,152	0.5%	3.9%
Industrial Machinery	6,353	38.5	0.3%	-0.1%	0.4	0.1	165	2.9%	39,938	46,988	0.6%	4.5%
Pharmaceuticals & Medical Technologies	4,522	14.8	0.2%	1.7%	0.0	0.0	305	4.1%	31,593	63,741	0.4%	6.0%
Aerospace	3,311	31.8	-0.2%	-3.7%	0.6	0.2	104	-2.8%	39,682	54,517	0.4%	3.7%

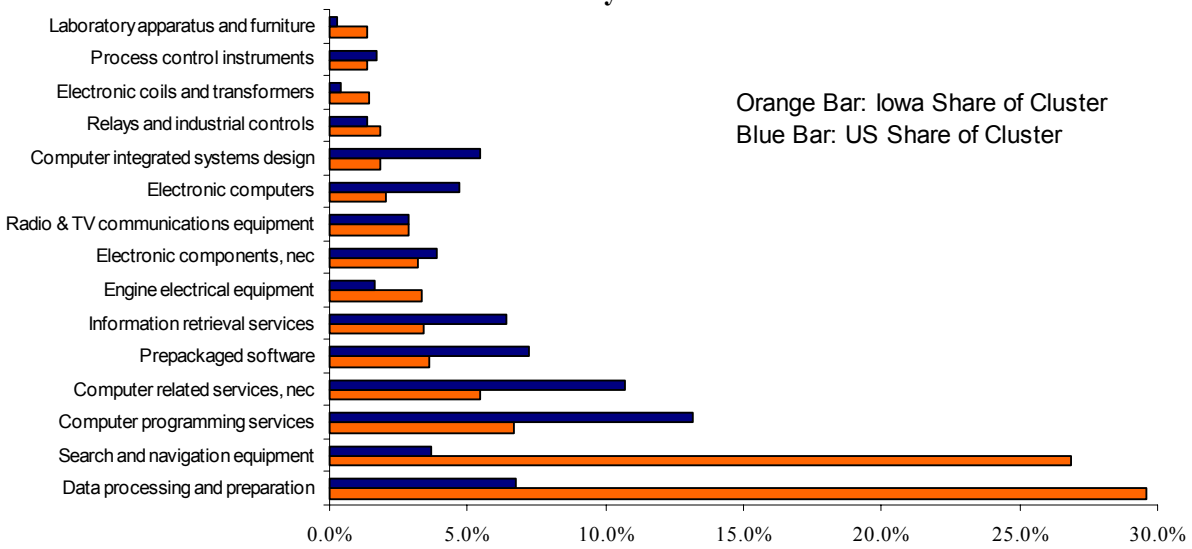
CAGR = compound annual growth rate

Information Technology and Instruments Technology Cluster

As Table 5 shows, the information technology and instruments technology clusters had the largest employment in Iowa in 2000 with over 34,000 jobs and nearly 1,500 establishments.

Employment in the cluster remained level between 1990 and 2000, while it grew at an annual rate of 3.6 percent at the national level. Figure 8 shows that the data processing and preparation industry (SIC 7374) and the search and navigation equipment industry (SIC 3812) are the two dominant sectors in this technology cluster with over half of the cluster's employment. At the U.S. level, the computer programming services industry (SIC 7371) and the computer related services, n.e.c. industry (SIC 7379) had the highest levels of employment in 2000.

Figure 8 - Information Technology and Instruments Technology Cluster Industry Mix



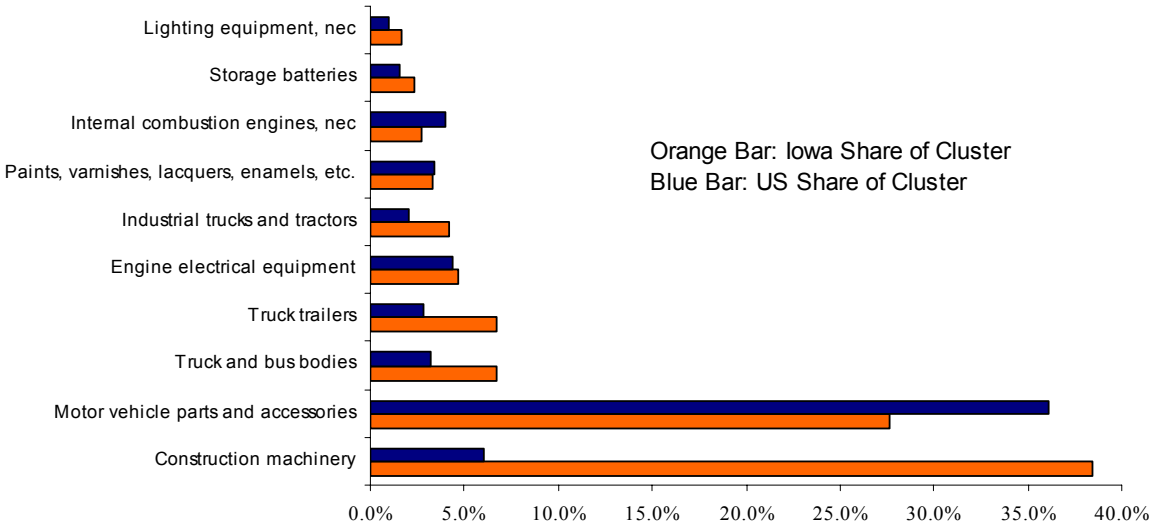
The annual average wage in 2000 for this technology cluster in Iowa was $41,288, which was over $30,000 lower than the cluster's average annual wage at the U.S. level ($75,343). A closer look at the two dominant industries in this cluster in Iowa helps to explain the substantial wage gap. The data processing and preparation industry had an average annual wage of $53,392 at the U.S. level but only $31,096 in Iowa, and the search and navigation equipment industry had an average annual wage of $65,138 at the U.S. level but only $51,569 in Iowa. Several other industries within the cluster, which have lower employment levels in the state, had even larger wage differences, such as the prepackaged software industry (Iowa - $40,397, U.S. - $118,632) and the information retrieval services industry (Iowa - $43,129, U.S. - $82,216).

According to IWD, the largest employers in the information technology and instruments technology cluster in Iowa include Rockwell Collins, Federal-Mogul, Celestica Corporation, Intermec Corporation, iMcKesson, Winegard Company, Siemens Energy & Automation, Allen-Bradley and Monona Wire.

Motor Vehicle Manufacturing Technology Cluster

The motor vehicle manufacturing technology cluster had the second highest employment levels in Iowa in 2000 with 24,634 workers. This cluster had 229 establishments and a payroll just over $1.0 billion. Figure 9 provides the industry mix of the cluster in Iowa. Greater than a third of the cluster's employment in Iowa is in the construction machinery manufacturing industry (SIC 3531), and over a quarter is in the motor vehicle parts and accessories industry (SIC 3714). At the U.S. level, the motor vehicle parts and accessories industry is the dominant employer with more than 36 percent. Employment in this cluster in Iowa declined between 1990 and 2000, while it grew at the U.S. level. The two largest industry sectors each declined significantly during the the 1990s. The construction machinery industry had an annual growth rate of –5.8 percent and the motor vehicle parts and accessories industry had an annual growth rate of –3.1 percent, while both of these sectors experienced growth at the U.S. level.

Figure 9 - Motor Vehicle Manufacturing Technology Cluster Industry Mix



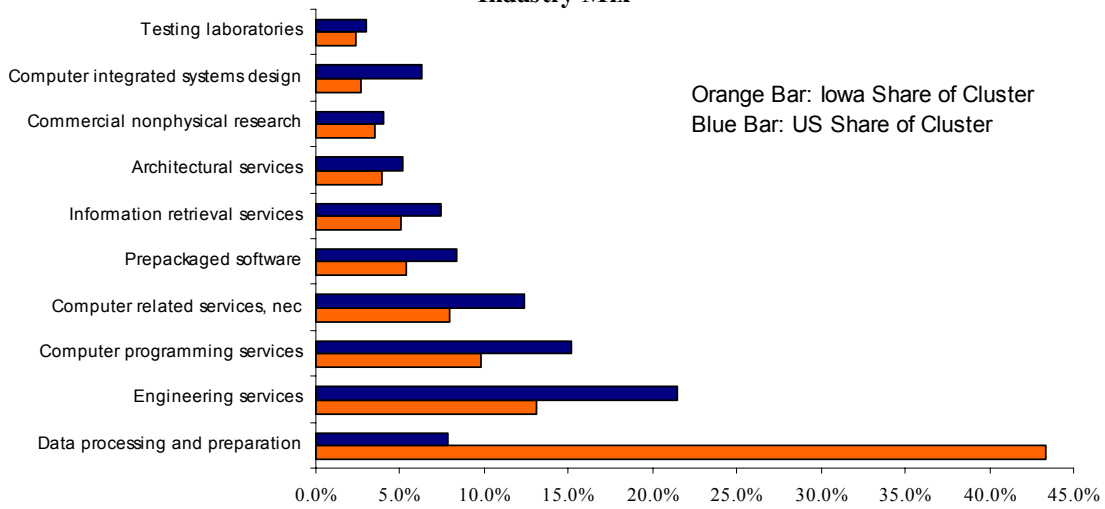
The motor vehicle manufacturing technology cluster at the national level experienced an annual average wage increase of 4.0 percent during the decade of the 1990s while in Iowa the annual wage growth rate was 0.4 percent per year for the same time period. In 2000, the cluster's average annual wage in Iowa was $40,755 and $51,561 at the U.S. level.

According to IWD, the largest employers within this technology cluster in Iowa include Vermeer Manufacturing, John Deere Construction Equipment, Sauer-Danfoss, Case Corporation, Donaldson Company, Federal-Mogul, Fleetguard, Exide Corporation and Wilson Trailer.

Communications Services and Software Technology Cluster

The communications services and software technology cluster had the third highest employment level in Iowa in 2000 with 23,383 jobs. This technology cluster experienced a growth in employment between 1990 and 2000 in Iowa and at the U.S. level (Iowa – 0.6 percent and U.S. – 6.3 percent). The cluster in Iowa had an average annual wage in 2000 of $39,202, which was more $30,000 below the cluster's annual average at the U.S. level ($69,973). Figure 10 shows the data processing and preparation industry (SIC 7373) is the dominant sector in this cluster in Iowa with 43.4 percent of the cluster's employment. The distribution of employment across the other major employing industry sectors in the cluster is comparable to the cluster's mix at the U.S. level. Engineering services (SIC 8711), computer programming services (SIC 7371) and computer related services, n.e.c. (SIC 7379) were the next largest employers in Iowa.

Figure 10 - Communications Services and Software Technology Cluster Industry Mix



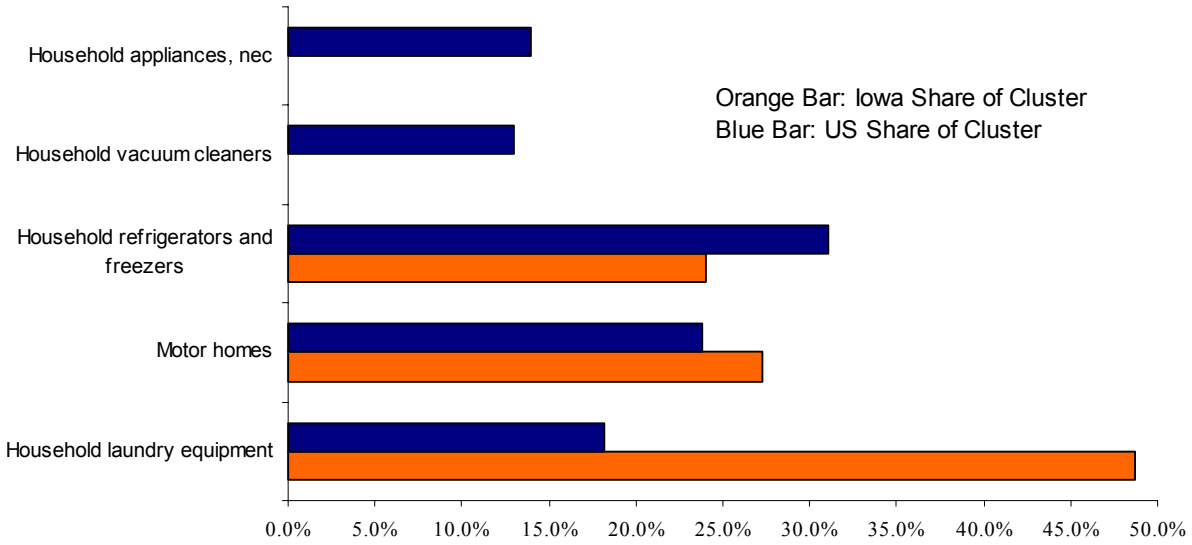
According to the IWD, the largest employers in Iowa in this technology cluster include ACT, the Army Corp of Engineers, iMcKesson, Stanley Consultants, Shive-Hattery, Siemens Transportation Systems, Lason Systems, Snyder & Associates and Howard R. Green Company.

Household Appliances Technology Cluster

The household appliances technology cluster had the fourth largest technology cluster in Iowa. With employment levels in 2000 of just over 12,000 in Iowa, the cluster is dominated by Maytag, Amana, Winnebago Industries and Frigidaire. Figure 11 shows that the household laundry equipment industry (SIC 3633) had nearly half of the cluster's employment. The cluster's average annual wage in 2000 in Iowa was just slightly lower than the national average,

$37,511 compared to $37,861. The average wage levels actually declined in Iowa between 1990 and 2000 (-0.2 percent annually) while they grew at the U.S. level (3.6 percent annually). The cluster also experienced a decline in employment levels in Iowa during the same period time, 0.1 percent annually.

Figure 11 - Household Appliances Technology Cluster Industry Mix



Benchmark Labor Skill Clusters

Each of the 17 benchmark labor clusters consist of industries that utilize similar workforce skills and occupations. As described earlier in this report, these labor clusters were identified through an analysis of data on the workforce staffing patterns of industries and data on the skills and knowledge requirements of occupations. An examination of a region's human capital has become critical since the availability and quality of labor are considered critical site selection criteria for businesses. Table 6 shows that employment changes for the benchmark labor clusters in Iowa and at the U.S. level were similar. Four labor clusters experienced employment declines during the 1990s: low skill, non-durable manufacturing, food and tobacco manufacturing, electronics, measuring devices and petroleum.

Table 6: Iowa Benchmark Labor Clusters

Description	Employment						Establish		Payroll			
			CAGR – '90-'00		Loc. Quotient				Average Wage - 2000		CAGR '90-'00	
	2000	Per Establ.	Iowa	US	2000	Chg '90-'00	2000	CAGR '90-'00	Iowa	US	IA	US
Health Services	117,862	23.0	0.3%	2.6%	1.1	-0.1	5,126	0.1%	29,665	34,928	0.4%	3.3%
Low Skill, Non-Durable Manufacturing	58,121	76.7	-0.1%	-1.4%	0.8	0.2	758	0.2%	38,270	33,710	0.5%	4.3%
Information Processing	56,672	13.4	0.7%	4.3%	0.7	-0.2	4,215	0.7%	40,521	59,714	0.5%	6.7%
Distribution, Freight Handling	43,978	11.7	0.2%	2.7%	1.3	-0.3	3,752	0.2%	30,755	35,845	0.4%	3.1%
Telecomm and Banking	42,959	15.7	0.2%	0.9%	0.9	0.1	2,737	0.3%	38,450	49,122	0.7%	5.5%
Standardized Heavy Industry	42,307	70.5	0.1%	0.4%	0.4	0.1	600	0.2%	37,069	47,271	0.3%	3.8%
Low Skill, Misc. Manufacturing	35,921	72.1	0.2%	0.2%	5.9	0.9	498	1.0%	28,614	33,161	0.2%	3.7%
Specialized Labor Intensive	29,810	49.3	0.0%	0.5%	0.8	0.1	605	1.0%	35,784	35,547	0.3%	3.5%
High End Information/Business Services	27,186	10.3	0.1%	0.6%	0.8	0.2	2,641	0.2%	33,864	50,280	0.5%	4.5%
Food and Tobacco Manufacturing	19,498	57.3	-0.4%	-0.6%	1.3	0.2	340	0.3%	41,846	43,456	0.4%	4.0%
Science Intensive	16,843	19.2	0.1%	0.4%	0.1	0.0	875	0.7%	45,538	57,027	0.4%	4.3%
Building Products	13,481	70.6	0.5%	1.6%	4.3	0.2	191	1.2%	31,696	32,860	0.4%	3.4%
Electronics, Measuring Devices	12,037	55.2	-0.4%	-0.4%	0.0	0.0	218	0.7%	37,401	66,125	0.7%	7.0%
High Tech Machinery, Instruments	10,867	24.9	0.0%	0.8%	0.4	0.0	437	0.1%	36,785	43,601	0.5%	3.9%
Chemicals, Pharmaceuticals	4,851	32.6	-0.6%	-0.3%	0.1	0.0	149	1.3%	46,692	73,849	0.9%	6.0%
Securities	2,960	4.3	0.4%	5.9%	0.2	-0.2	686	0.7%	72,278	147,281	0.2%	8.6%
Petroleum	983	11.7	-0.3%	-4.1%	0.8	0.4	84	10.1%	43,690	59,958	0.2%	4.1%

CAGR = compound annual growth rate

Health Services Labor Cluster

The largest benchmark labor cluster in 2000 for Iowa and the U.S. was the health services labor cluster. At the U.S. level, this labor cluster had an annual growth rate of 2.6 percent, which was one of the highest annual percentage growth rates behind the securities, information processing and distribution, freight handling labor clusters. However, in Iowa the health services labor cluster had an annual growth rate of only 0.3 percent. As Table 6 shows, the health services labor cluster in Iowa employed approximately 118,000 workers in 2000, twice as many as the next largest labor cluster (low skill, non-durable manufacturing labor cluster). The health services labor cluster had an average annual wage rate of $29,664 in Iowa, which was lower than the annual average at the national level which was $34,928. The U.S. outpaced Iowa in annual wage growth in this cluster between 1990 and 2000 with an annual rate of 3.3 percent, while Iowa had an annual rate of wage growth of 0.4 percent.

Figure 12 - Health Services Labor Cluster Industry Mix

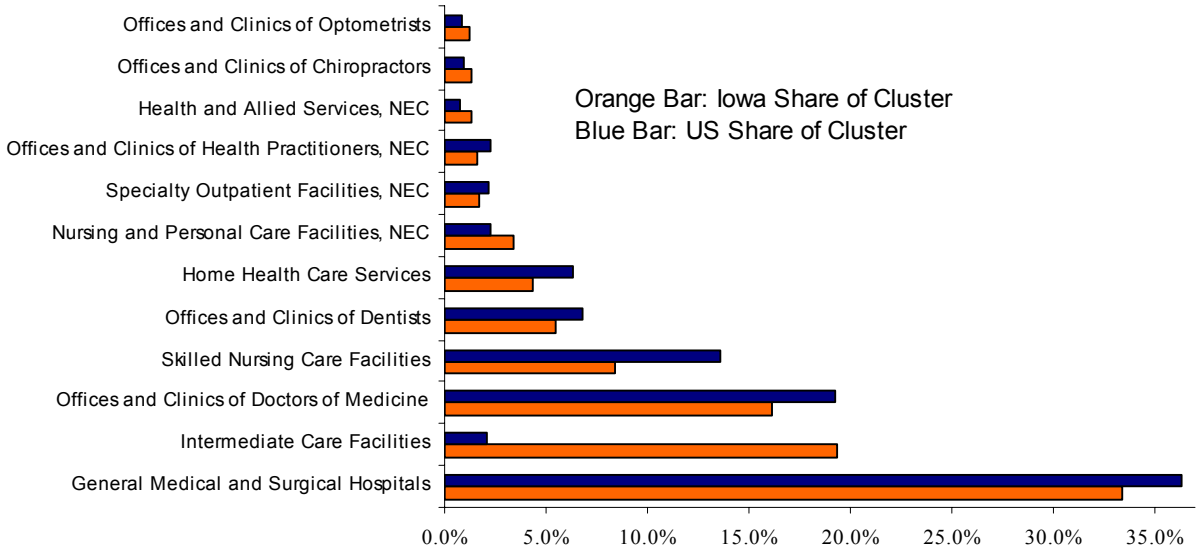


Figure 12 shows that in 2000 in Iowa and at the U.S. level the general medical and surgical hospitals industry (SIC 8062) was the largest employer. That sector had a third of the labor cluster's employment in Iowa. The intermediate care facilities industry (SIC 8052) was the second largest industry sector employer in the labor cluster with 19.4 percent of the cluster's employment in 2000. At the U.S. level, the second largest sector was the skilled nursing care facilities industry (SIC 8051). The most common occupations in the general medical and surgical hospitals industry are registered nurses and nursing aides, orderlies and attendants; and the most common occupations in the intermediate care facilities are nursing aides, orderlies and attendants and licensed practical nurses and licensed vocational nurses.

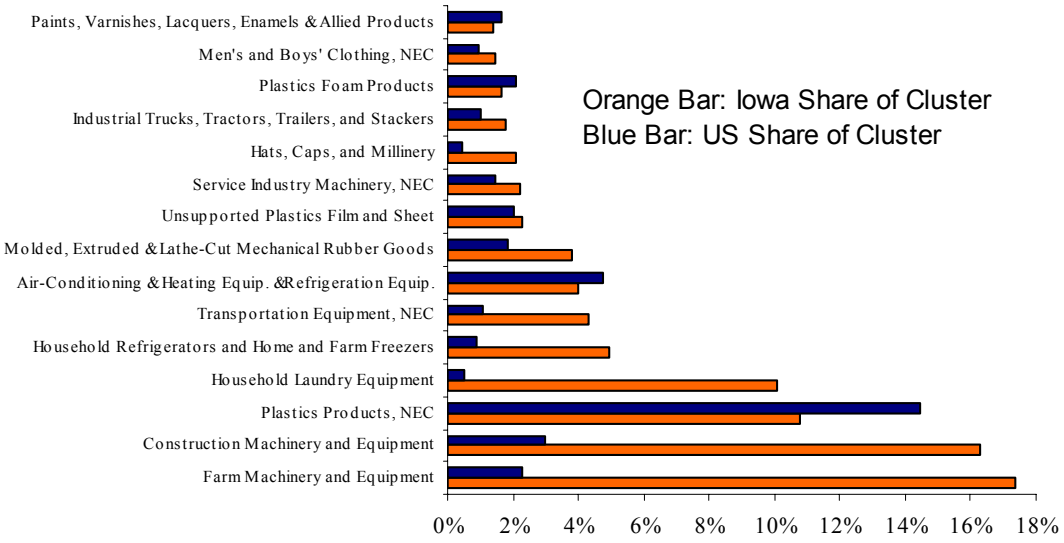
Low Skill, Non-Durable Manufacturing Labor Cluster

The low skill, non-durable manufacturing labor cluster had the second highest employment levels in 2000 in Iowa with 58,121 employees. Employment in this labor cluster declined both in Iowa and at the U.S. level between 1990 and 2000. The farm machinery and equipment industry (SIC 3523) is the largest sector followed closely by the construction machinery and equipment industry (SIC 3531). Figure 13 illustrates that the plastic products, n.e.c. industry (SIC 3089) and household laundry equipment industry (SIC 3633) also had a large share of the labor cluster's employment. At the U.S. level the plastic products, n.e.c. industry

(SIC 3089) was the only industry sector that had an employment concentration above 10 percent (14.5 percent).

In 2000, the low skill, non-durable manufacturing labor cluster had an annual average wage in Iowa of $38,270 and $33,710 at the U.S. level. At the state level, the labor cluster experienced an annual percentage wage growth of 0.5 percent while at the the U.S. level it was well above 4 percent (4.3 percent) This trend is likely to continue in Iowa due to labor restructuring in several key industries within the cluster, such as the farm machinery and equipment industry, where new production workers within the industries are hired under different wage scales than existing unionized employees.

Figure 13 - Low Skill, Non-Durable Manufacturing Labor Cluster Industry Mix

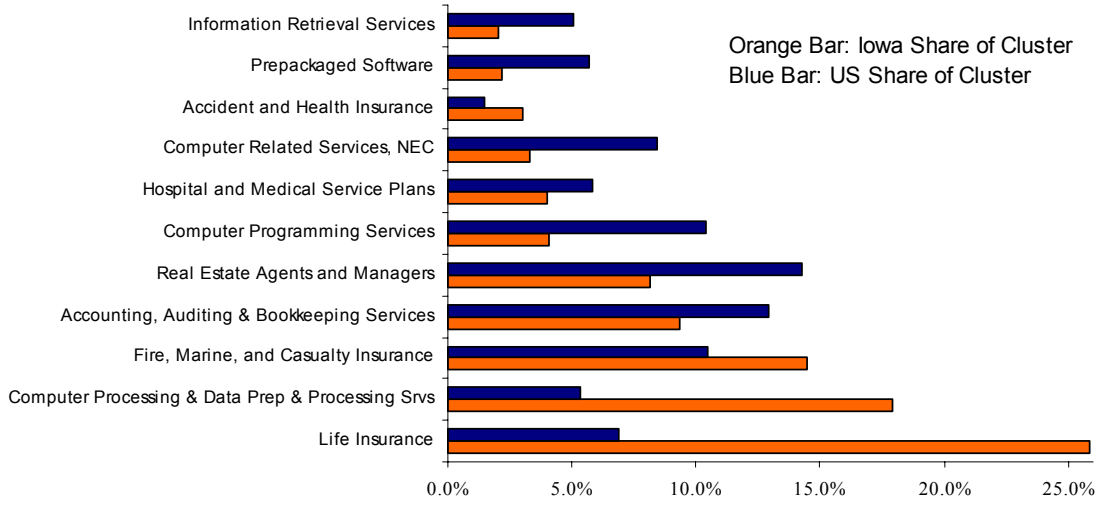


The most common occupations in the farm machinery and equipment industry are assemblers, welders, cutters, solderers and brazers, production and operating workers supervisors, and metal and plastic cutting, punching and press machine operators and setters. The most common occupations in the construction machinery and equipment industry included welders, cutters, solderers and brazers, assemblers and machinists. The largest employers in this labor cluster according to IWD include Deere & Co., Vermeer Manufacturing, Lennox Manufacturing, Metzeler Auto Profilesys Iowa, American Marketing Industries and Case Corporation.

Information Processing Labor Cluster

Iowa's third largest labor cluster by employment in 2000 was the information processing labor cluster with 56,672 employees. Employment in this cluster grew between 1990 and 2000 in Iowa and nationwide. (Iowa – 0.7 percent and U.S. – 4.3 percent) The life insurance industry (SIC 6311) had just over a quarter of this labor cluster's employment in Iowa in 2000. The computer processing and data preparation and processing service industry (SIC 7374) and the fire, marine and casualty insurance industry (SIC 6331) each had greater than 10 percent of the labor cluster's employment. Figure 14 shows that at the U.S. level, the labor cluster's major industry sectors are the accounting industry (SIC 8721), the real estate agent and manager industry (SIC 6531), the computer programming services industry (SIC 7371) and the fire, marine and casualty insurance industry (SIC 6331).

Figure 14 - Information Processing Labor Cluster Industry Mix



The information processing labor cluster had an annual average wage in 2000 that was nearly $20,000 higher at the U.S. level than in Iowa, $59,714 compared to $40,521. An obvious reason is that the industries within the information processing labor cluster with higher paying occupations, such as the prepackage software industry (SIC 7372), the information retrieval services industry (SIC 7375), the computer integrated systems design industry (SIC 7378) and the computer related services industry (SIC 7379), either have a small presence in Iowa or no presence at all. The major occupations within these industries are computer programmers, computer software engineers, computer support specialists and computer system analysts.

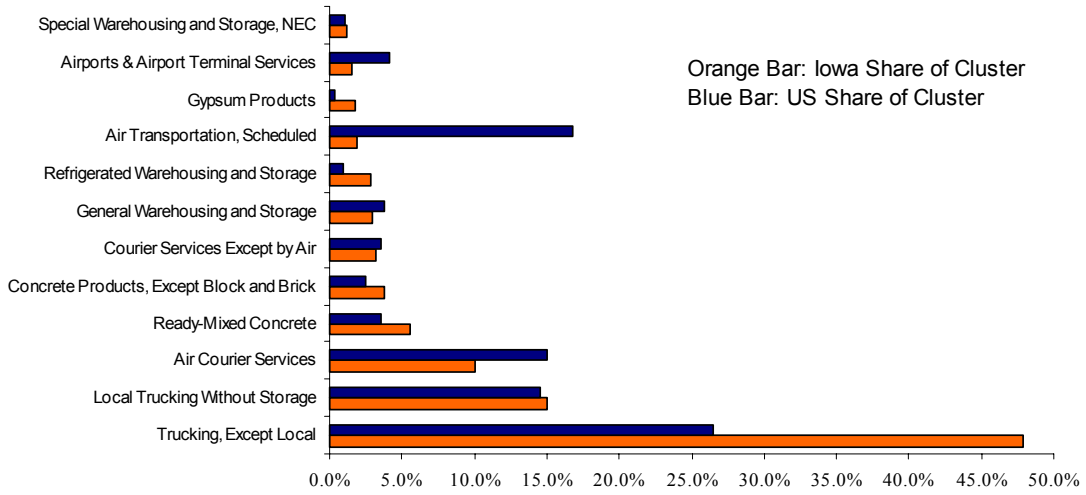
The most common occupations in the life insurance industry include insurance sale agents, customer service representatives and insurance claims and policy processing clerks. The most common occupations in the computer programming, data processing and computer related services industries include computer programmers, computer software engineers, computer support specialists and customer services representatives.

Distribution, Freight Handling Labor Cluster

The distribution, freight handling labor cluster had the fourth highest level of employment in Iowa in 2000 with 43,978 employees. As would be expected, since the cluster focuses on the movement of goods, the non-local trucking (SIC 4212) and the local trucking without storage (SIC 4212) are the largest industry sectors in Iowa. Figure 15 shows that the non-local trucking industry had close to half of the labor cluster's employment in Iowa in 2000. At the U.S. level, the trucking industry and air transportation related industries were the largest employers.

An annual average wage of $30,755 for the distribution, freight handling labor cluster in Iowa was lower than the labor cluster's average wage at the U.S. level which was $35,845. The most common occupations in the trucking industry are heavy and tractor-trailer truck drivers, light or delivery services truck drivers and laborers and freight, stock and material movers.

Figure 15 - Distribution, Freight Handling Labor Cluster Industry Mix



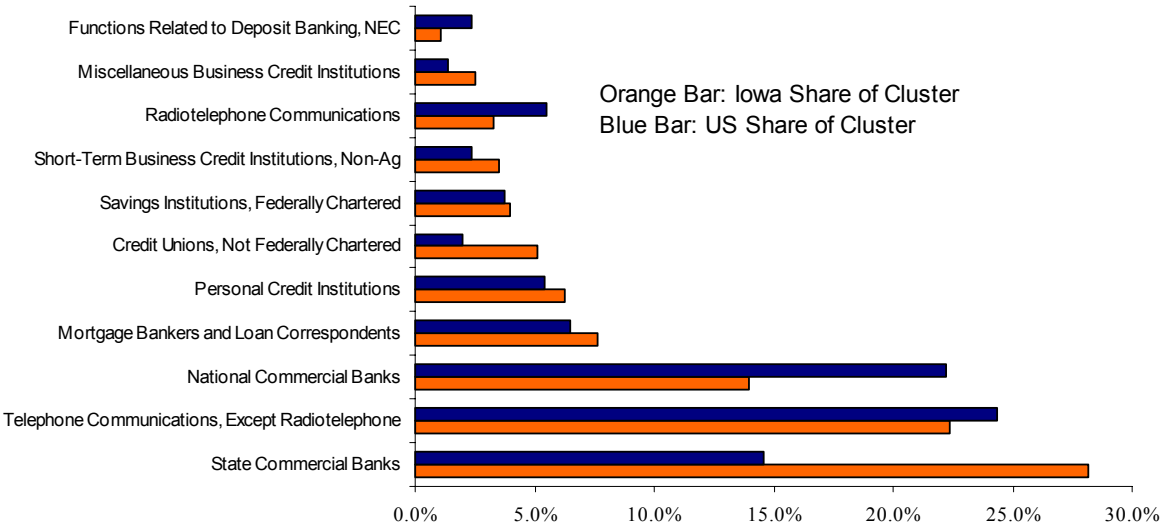
According to IWD, the largest employers in Iowa in the distribution, freight handling labor cluster include United Parcel Service, CRST Inc, Heartland Express of Iowa, Barr-Nunn

Transporation, West Side Transport, Smithway Motor Xpress, Cloverleaf Cold Storage, United States Gypsum and Federal Express.

Telecomm and Banking Labor Cluster

The telecomm and banking labor cluster in Iowa had an employment level of 42,959 workers in 2000. The state and national commercial banking industries (SIC 6022 and SIC 6021) contained the majority of the employment in Iowa in 2000 with 28.2 percent for the state commercial banking industry and 14.0 percent for the national commercial banking industry. The telephone communications industry (SIC 4813) had that second highest employment in the labor cluster with 22.4 percent of the cluster's employment. Figure 16 shows that these employment levels were similar to the employment in the cluster at the at the U.S. level. Between 1990 and 2000, employment in the labor cluster grew at the U.S. level and in Iowa. The U.S. had an annual growth rate of 0.9 percent and Iowa had employment grow by 0.2 percent annually.

Figure 16 - Telecom and Banking Labor Cluster Industry Mix



The average annual wage for the telecomm and banking labor cluster was higher at the U.S. level than in Iowa. The U.S. average wage in 2000 was $49,122 while the Iowa's average annual wage was $38,450. At the U.S. level, the largest industry in this labor cluster is the telephone communications industry, with nearly a fourth of the employment. The industry's annual average wage was $61,314, while Iowa's wage was $48,858. The two banking industry sectors in Iowa, the state and national commercial banks industries, had annual average wages in

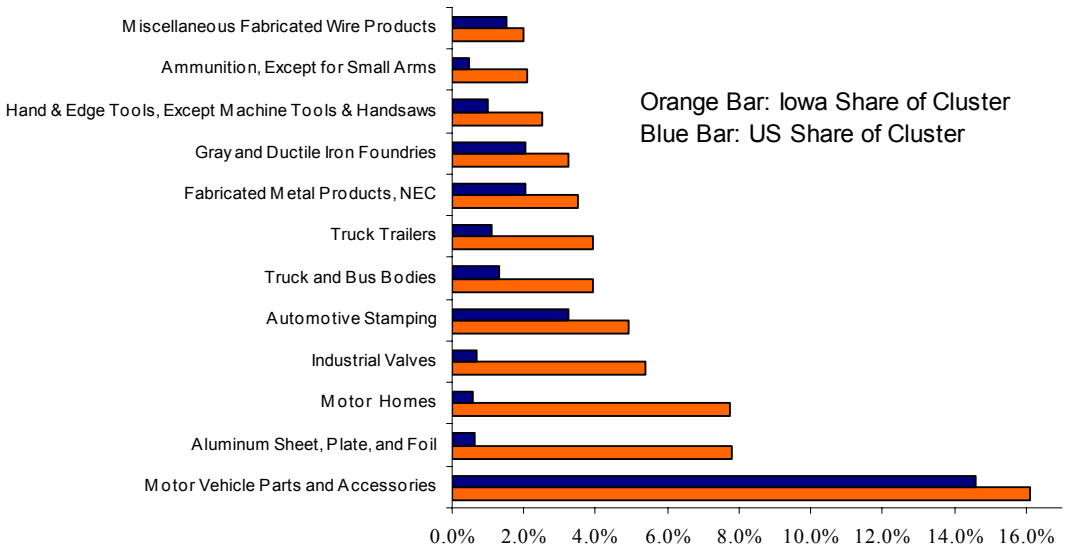
2000 of $31,073 and $36,093 respectively, These wages were roughly $10,000 and $5,000 less than the national annual average wages of $41,829 and $41,754.

According to IWD, the largest employers in Iowa in this telecom and banking labor cluster include Wells Fargo Home Mortgage, Wells Fargo Bank, US Bank, Wells Fargo Financial, CitiCorp Credit Services, GMAC Mortgage, Principal Residential Mortgage and Deere Credit Services. The most common occupations in the commercial banking industry were tellers, customer service representatives and first-line supervisors/managers of office and administrative support workers. The most common occupations in the telephone communications industry were customer service representatives, telecommunication line installers and repairers, telephone operators and general office clerks.

Standardized Heavy Industry Labor Cluster

Iowa's standardized heavy industry labor cluster had an employment level of 42,307 workers in 2000. Employment in this cluster grew slightly between 1990 and 2000 (0.1 percent annually) while the labor cluster grew by 0.9 percent annually at the U.S. level. Figure 17 shows that in 2000 the motor vehicle parts and accessories industry (SIC 3714) had the highest level of employment in this labor cluster both in Iowa (16.1 percent) and at the U.S. level (14.6 percent), with a 16.1 percent share in Iowa and 14.6 percent share at the U.S. level.

Figure 17 - Standardized Heavy Industry Labor Cluster Industry Mix



There is a $10,000 difference in the average annual wage between Iowa ($37,069) and the U.S. ($47,271) for this labor cluster. This wage difference is similar to the gap between Iowa and the U.S. for the motor vehicle parts and accessories industry (SIC 3714). The annual average wage for the industry in Iowa is $36,285 while the annual average wage at the U.S. level was $47,924. According to IWD, the largest employers in this labor cluster include Winnebago Industries, ALCOA, Fisher Controls, Eaton Corporation, American Ordnance, Sauer-Danfoss, Donaldson Company, Amsted Industries, Federal-Mogul, Heatilator and Textron. The most common occupations in the motor vehicle and motor vehicle equipment industries include welders, cutters, solderers and brazers, inspectors, testers, sorters, samplers and weighers, and production and operating worker supervisors.

Comparison of the Three Pilot Regions' Clusters

Tables 7, 8 and 9 compare the five benchmark value-chain clusters, benchmark technology clusters and benchmark labor clusters which had the largest employment in 2000 statewide and in the three pilot regions. Table 7 shows that two value-chain clusters had a significant employment presence in each of the pilot regions and statewide: the metalworking and industrial machinery industry cluster and the construction materials industry cluster. The metalworking and industrial machinery industry cluster had the largest employment statewide and in the Southeast Iowa Region and the Iowa Great Lakes Region. In this cluster, statewide and in the Iowa Great Lakes Region, the farm machinery and equipment industry (SIC 3523) were the cluster's largest employer; while in the Southeast Iowa Region, the construction machinery industry (SIC 3531) was the cluster's largest employer. The packaged food products industry cluster was the largest value-chain cluster in the Carroll Area Region in 2000, which was dominated by the meat packing industry (SIC 2011).

Table 7: Five Largest Value-Chain Clusters by Employment

State of Iowa	Southeast Iowa Region	Carroll Area Region	Iowa Great Lakes Region
Metalworking and industrial machinery	Metalworking and industrial machinery	Packaged food products	Metalworking and industrial machinery
Hospitals, labs, and specialized medical services	Motor vehicle manufacturing	Metalworking and industrial machinery	Fabricated textiles
Printing and publishing	Construction materials	Hospitals, labs, and specialized medical services	Construction materials
Construction materials	Hospitals, labs and specialized medical services	Construction materials	Transportation, shipping, and logistics
Packaged food products	Information technology and instruments	Transportation, shipping, and logistics	Printing and publishing

(The white cells in the table are value-chain clusters that were only one of the five largest value-chain clusters in one of the three pilot regions. Columns are ordered from largest cluster to fifth largest cluster.)

Two regions had large value-chain clusters that were unique among their five largest (2000) compared to the other pilot regions. In the Southeast Iowa Region, the motor vehicle manufacturing industry cluster was the second largest value-chain cluster and the information technology and instruments industry cluster was the fifth largest cluster. The fabricated textiles industry cluster was the second largest value-chain cluster in the Iowa Great Lakes Regions.

Table 8 shows that three of the benchmark technology clusters were among the five largest technology clusters statewide and in each of the pilot regions: the chemicals and plastics technology cluster, the communications services and software technology cluster and the motor vehicle manufacturing technology cluster. It should be noted that employment levels in 2000 in the technology clusters were very small in the Carroll Area Region and the Iowa Great Lakes Region. The five largest technology clusters in the Iowa Great Lakes Region ranged in size from 48 employees to 143 employees while in the Carroll Area Region they ranged in size from 89 employees to 161 employees. In comparison, the two largest technology clusters in the Southeast Iowa Region had employment levels of 3,076 and 2,416 in 2000.

Table 8: Largest Technology Clusters by Employment

State of Iowa	Southeast Iowa Region	Carroll Area Region	Iowa Great Lakes Region
Information Technology and Instruments	Motor Vehicle Manufacturing	Household Appliances	Chemicals and Plastics
Motor Vehicle Manufacturing	Information Technology and Instruments	Motor Vehicle Manufacturing	Motor Vehicle Manufacturing
Communications Services and Software	Chemicals and Plastics	Communications Services and Software	Information Technology and Instruments
Household Appliances	Industrial Machinery	Aerospace	Communications Services and Software
Chemicals and Plastics	Communications Services and Software	Chemicals and Plastics	Industrial Machinery

(The white cells in the table are technology clusters that were only one of the five largest technology clusters in one of the three pilot regions.)

The aerospace technology cluster in the Carroll Area Region was the only technology cluster that was unique among the five largest technology clusters in the three pilot regions.

Table 9 shows that the health services labor cluster was also the largest labor cluster in each of the pilot regions. In the health services labor cluster, general medical and surgical hospitals were the largest employers at the U.S. level, in Iowa and in the Southeast Iowa Region, while intermediate care facilities were the largest employers in the Carroll Area Region and the Iowa Great Lakes Region.

The distribution, freight handling labor cluster was the only other labor cluster that the three pilot regions and Iowa all had in common among their five largest labor clusters. It should be noted that since the year 2000, Great Lakes Aviation has moved its operations out of Spencer, which reduces this labor cluster's employment levels in the Iowa Great Lakes Region by nearly 240 workers, down to an employment level just over 500 workers, an employment level that would still be among the largest labor clusters in the Iowa Great Lakes Region.

Table 9: Largest Labor Clusters by Employment

State of Iowa	Southeast Iowa Region	Carroll Area Region	Iowa Great Lakes Region
Health Services	Health Services	Health Services	Health Services
Low Skill, Non-Durable Manufacturing	Standardized Heavy Industry	Low Skill, Misc. Manufacturing	Low Skill, Non-Durable Manufacturing
Information Processing	Electronics, Measuring Devices	Distribution, Freight Handling	Specialized Labor Intensive
Distribution, Freight Handling	Low Skill, Non-Durable Manufacturing	Information Processing	Distribution, Freight Handling
Telecomm and Banking	Distribution, Freight Handling	Telecomm and Banking	Telecomm and Banking

(The white cells in the table are labor clusters that were only one of the five largest labor clusters in one of the three pilot regions.)

The standardized heavy industry labor cluster in the Southeast Iowa Region, the low skill, miscellaneous manufacturing labor cluster in the Carroll Area Region and the specialized labor intensive labor cluster in the Iowa Great Lakes Region were the only labor clusters that were unique among the five largest technology clusters in the three pilot regions.

Strategies for Cluster-Based Economic Development

The previous sections of this report have provided an overview of what industry clusters are, reasons why firms cluster, the benefits derived by firms and the challenges of sustaining growth in clusters. A usable framework for identifying clusters in a region was examined and utilized to identify value-chain clusters, technology clusters and labor clusters in Iowa statewide. This section sets out to provide communities, regions and the State with ideas of potential strategies that can help to foster and develop industry clusters within Iowa. A review of the strategies discussed demonstrates that many are commonly known and used economic development strategies. Also, the implementation of these strategies will likely provide benefits to a community or region, and the businesses in the region, even if there are not strong industry cluster dynamics or "critical mass" present in the region.

With resources (both financial and human) so scarce for economic development efforts at the local, regional and state levels, most communities and regions will find it challenging to implement the elaborate cluster-based strategies that are often highlighted in academic and economic development professional literature. If a community or region does decide to focus its economic development efforts around clusters and cluster development, it is important that the strategies implemented complement and build upon each other. That said, many of the strategies and ideas outlined in this section could be implemented separately or in concert with others as resources are secured.

Identification of Clusters

An obvious first step for a community or region to undertake a cluster based approach is to identify and assess the industry clusters that have a presence in their regional economy. These activities should include both quantitative and qualitative analysis. This initial step will help a community gain a better understanding of its economic base, the actual or potential buyer-supplier linkages between firms and the relationships that exist between firms and other organizations in the region, such as colleges and universities.

Quantitative Analysis

The benchmark cluster framework developed by Feser and Bergman (2000) is a good approach for identifying and quantifying the potential presence of value-chain clusters, technology clusters and labor clusters using input-output data or other industry data. Even the calculations of location quotients for industries in the region will provide insight into the level of industry concentration in the region.

Qualitative Analysis

Qualitative research involves gathering information that is more difficult to measure. It typically includes using surveys, interviews or focus groups with CEOs, plant managers, outreach staff from area community colleges, universities and utilities to learn and become familiar with the industries in the region and gain a thorough understanding of the connections and interactions between businesses in a region. The qualitative research helps to evaluate the quantitative research and determine if the clusters that were identified in the quantitative research actually do exist or could exist in the future. The input received can also help determine key individuals, firms or organizations that are or could be catalysts for cluster development. It also helps to determine the geography of a cluster within a region by identifying relationships among firms within the region and beyond. Communities and regions that have a business visitation program as part of their business retention activities can readily adjust their efforts to accomplish this qualitative research, however, the cluster approach may require a more focused approach than what is currently in place.

Initiation of Collaboration

A critical first step in exploring the presence of industry cluster dynamics in a region and developing and implementing cluster-based economic development strategies is the building of awareness, interest and active participation among the various businesses and organizations that will be stakeholders in implementation. It is often easier to mobilize stakeholders during times of economic crisis. However, ideally a region should be proactive and not wait for an economic crisis. This is especially true where there are several key large employers or industries that anchor the region's economic base. Stakeholders likely will include industries in the region that are the cornerstone of the economy and future growth, local and regional support organizations such as local governments, school districts, community colleges, public and private colleges and universities, financial institutions, organized labor, utility companies, state agencies and other

support agencies. A core group of these stakeholder businesses and institutions needs to be "onboard" for cluster-based strategies to be successfully launched and implemented. This collaboration may challenge businesses and other organizations to develop new relationships or restore old networks.

Private Sector Leadership

To be successful, cluster-based economic development strategies must be "championed" by the private sector. Throughout the literature on industry clusters there is a common theme that cluster-based development strategies are most often led by the private sector (see Rosenfeld 1995; Porter, 2000; Gollub, 1997). Individual firms and industries are the main focus of cluster development so they are likely to be in the best positioned to identify issues, needs, barriers and opportunities for growth. The private sector can also help to focus attention on issues and help to avoid or minimize political issues that will likely arise. Many cluster-based strategies, such as education/training programs or technology transfer programs, are implemented regionally and require new approaches for the delivery of services by public and private sector organizations to businesses and industries. Private sector leadership can also challenge old assumptions held about how economic development should be approached in a region.

Role of Government

As mentioned above, the private sector is often in a leadership role for cluster development. U.S. and international experience has shown that government alone cannot create industry clusters, but can help to foster conditions that allow for cluster development in the private sector (Rosenfeld, 1995). There are many roles that can be played in this capacity. Some states, like Arizona, have taken a strong leadership position in getting cluster strategies off the ground and then, once a cluster-focused, private-sector led working group, formal organization or association is in place, changed their role to a support position (Waits, 2000).

Government officials can often be active participants from the beginning of the cluster-based economic development efforts and often learn that the new initiatives may require them "to change how they do business." Government agencies may have to change the rules and procedures for existing programs to be more flexible in serving businesses or individuals. Also, agencies may need to discontinue an existing program and replace it with a new program that is cluster-focused. It is critical that government officials, particularly elected officials, have a good grasp of what the region is attempting to accomplish through cluster-based economic

development. They must understand the need for patience with the economic development process, both in the short-term, related to identifying industry clusters and the development of cluster-focused strategies, and in the longer-term, in the growth and sustainability of the regional economy. When government officials understand and support cluster-based economic development they help to legitimize the implementation of new strategies, raise the public profile of efforts and serve as cluster spokespersons or champions in local, regional and national media. Many of the strategies included below can involve government participation either in a lead, secondary or support role.

Organizational Structure

Some regions form cluster-focused working groups, "cluster councils" or cluster teams that focus on one cluster or a group of clusters. Such a group may be established as a formal organization or task group sponsored by several entities and administratively supported by local economic development or college/university staff. In regions where resources are limited and incremental steps are more appropriate, an informal work group approach could be utilized. Even though its efforts may be smaller in scale and implementation gradual, the working group should also have private and public sector leadership and a broad representation from key stakeholders. What is most important is to get organized and begin meeting to determine what would be appropriate cluster-based strategies and how those strategies could be integrated into the region's existing economic development efforts and plans.

Communication and Information Flow with Business

The interaction between firms and organizations that support firms in an industry cluster or a specific industry is critical. Therefore, a community or region should determine appropriate methods to create communication channels and information exchanges early in the process. Effective communication and interaction is important in fostering inter-firm and firm-government/service organization collaboration. Effective communication is an essential dynamic of all successful industry clusters. The interaction may involve formal relationships, such as buyer-supplier relationships, or more informal relationships through community involvement in the Chamber of Commerce. These relationships help to build and foster the social capital in the region. An important aspect of successful communication is the assurance of confidentiality and trust among firms, government and organizations.

Existing Industry Programs

A cornerstone strategy for cluster-based economic development can be an effective existing industry program or business call program. This may involve various activities such as an annual business survey and visits to determine business needs and trends in the region and beyond. The existing industry program will also communicate to the businesses their importance to the region and will build relationships with the businesses. As mentioned above, this type of fact-finding provides an opportunity to learn first-hand about clustering dynamics that are present in a region. The business visits are often conducted by volunteers who are in the business community so they help foster interaction among business leaders. Other activities undertaken by many communities and regions that help to foster communication and build relationships between business leaders include industry roundtables or CEO/plant manager networks and human resource consortiums that may address unique workforce needs related to the cluster. Business leaders take the initiative to set the agenda and run these meetings. Some regions have created councils that undertake activities such as cluster-specific infrastructure development, marketing of the cluster and its products/services or tracking industry trends occurring regionally, nationally and internationally.

Fostering Innovation and Research

An awareness of broader trends and advances is important to any business or industry whether it is within an industry cluster or not. It is important that research be conducted at the regional or state level to uncover linkages and new opportunities for businesses and service providers outside of the industry cluster and the region. These linkages will be important sources for new innovation, knowledge, technology and best practices from other industries/businesses, as well as, sustain and expand markets and competitiveness. Such activities may involve assisting several smaller businesses with organizing, underwriting the costs for their participation in a national or international tradeshow to help the firms gain access to new markets, or offering training in the region on specific best practices in business or on new technologies that can assist regional businesses to become more productive and competitive.

Some professions and occupations already have national or regional professional associations that help to facilitate interaction between individuals and the exchange of ideas and knowledge concerning new innovations, practices or technologies. Unfortunately, in many smaller communities and regions those professional associations do not have a presence or local

chapters. As part of the new cluster approach, it may be appropriate for the local economic development group, community college or school districts to initiate strategies to begin to enhance communication and interaction between various professions that are critical to the regional economy. This may involve creating ways for local businesses to participate in meetings or gain membership in associations outside of the region to gain much needed information and insight.

Regional Communication and Coordination Among Economic Development Organizations

If cluster-based development is to be a focus in a region, then coordination and communication across the region will be critical so that the needs of businesses are being identified and addressed. Therefore, an essential component for cluster-based development, and regional development in general, is the interaction between economic development organizations. The interaction should include not only the economic development professionals but also the organizations' board leadership. In many regions the local economic development professionals already meet on a regular basis to discuss issues and share information. These interactions should be expanded to include board leadership. As these relationships grow and strengthen, regional economic development strategies and programming can be implemented more effectively. Joint efforts could include coordinated existing industry programming, regional industry roundtable meetings or regional external marketing to targeted industries that would complement the existing industry cluster.

Challenges to Regional Cooperation

There are also many challenges for communities and organizations that work together regionally. Competition between communities is always an issue that must be recognized and dealt with. Another challenge involves balancing a community's needs, often short-term, with the long-term goals of the regional effort. Funding will likely be a hurdle for a cluster-based approach as it is with most development efforts. The dynamics include trying to find adequate funding for local and regional efforts using limited public and private dollars for economic development. Most public funds are appropriated by elected officials who may have a short-term focus on re-election, which is often counter to the need for patience when following a longer-term and geographically-broader approach for economic development.

Delivery of Information and Services

Cluster-based economic development requires a different perspective on the delivery of information and services. Customized services and information should be developed to fit the needs and dynamics of industry clusters. Community and regional information and data is typically collected and organized by specific industries and compiled by political boundaries that do not reflect the industry cluster or the regional economy. It may be more appropriate to collect or re-calculate data and information based on the industry clusters that have a presence in a region. For example, the development of Iowa's laborshed studies helped to make available labor market information that better reflects a community and region's labor pool. Iowa Workforce Development provides customized laborshed data for clusters within regions. The collecting, organizing and dissemination of data and information based on industry clusters will help to enhance the process of educating people about industry clusters and the presence of clusters in a region or state.

There are a range of service providers, from universities to community colleges to state agencies, which offer various forms of services and technical assistance to businesses. These services have traditionally been tailored to the needs of individual firms or specific industries. An industry cluster focus will require that many of these services and programs be customized to fit the needs and dynamics of clusters that include firms of varying size and firms from different industries. It will be important that all services be designed so that they are accessible to all firms, both small and large. As mentioned previously, this may require some services being underwritten for new or small businesses. Services may focus on technology enhancements, process modernizations, market research, workforce training, research and development assistance and exporting assistance. What is important is that the services and programs are timely and flexible to help meet actual and changing needs. To ensure this, some service providers have staffed cluster-specific programs with individuals who have relevant industry experience that enables them to understand the needs and problems of the industries in the clusters being served (Rosenfeld, 1995).

The flexibility of services will also likely require greater collaboration among service providers to meet industry needs and provide effective services. In a time of tight public-sector budgets, the need for collaboration and joint efforts among public institutions and agencies is even more critical. Rosenfeld, in *A Governor's Guide to Cluster-Based Economic Development*,

recommends that service providers create "cross-agency cluster teams" that involve multiple agencies and that are multi-disciplinary (National Governors Association, 2002). These teams would be similar in concept to teams that some communities organize for prospect visits or the "rapid response" teams that some states have created to respond to a mass lay-off or plant closing (each participating organization assumes responsibility for an area of expertise that is valuable to the industry clusters). Such an approach allows for a quicker and broader provision of services. It is important to note that this type of division of responsibility requires complete "buy-in" from all participating agencies and the individual staff members to be successful.

Workforce Development, Education and Training

Human capital continues to grow in importance for firms, industries and clusters. Richard Florida (2002) in *The Rise of the Creative Class* illustrates how the new economy is being built around human capital and that regions which are not able to retain and attract talent will have economic difficulties in the long run. In its most recent annual corporate survey, *Area Development* found that the availability of skilled labor was the top site selection factor identified by corporate respondents (December, 2002). The development and retention of a skilled workforce can require a variety of efforts and strategies.

Because a skilled workforce is a critical factor in the success of cluster-based economic development undertaken by a community and a region, it is important that strategies be in place to train workers for occupations that are currently needed by employers or will be needed in the future due to workforce attrition or technological advances. Workforce skills are often classified into general skills (basic skills that are important and transferable across industries and employers) and "leveraged skills" (skills that are industry specific) (Steward, 1997). Cluster-based development will require workforce development strategies that help to foster those leveraged skills and ensure the basic skills of existing and future workers in the region. As with the provision of services discussed above, the provision of workforce specific services must be flexible. Skill development and retraining efforts will require a mix of short-term and long-term credit and non-credit course offerings. Education and training should be offered at locations and at times that are most suitable to meet those needs, whether on site or in a training center or classroom. The programs and curriculums should be up-to-date regarding industry trends, technology and practices. Active participation by industry in the design and implementation of training and educational programs is critical. An example of this is industry cluster firms or their

suppliers providing equipment to educational institutions to be used in training and courses. Another example is the participation of businesses in inter-firm training networks or consortiums that can provide cost-effective, management-level training in a region, such as efforts by the Management and Professional Development Center at the University of Northern Iowa.

Experiential learning opportunities for students are another avenue for firms to actively participate in workforce development efforts. Internships, apprenticeship programs, career days and fairs are all efforts that can be undertaken within a region to help high school and college students develop their skills and learn more about industries and careers. Two examples of efforts undertaken are the Kossuth County Internship Program in Northwest Iowa which helps to place interns in its area in the hope of expanding its future workforce, and the Delaware County Career Alliance which annually holds a career fair that targets high school students and their parents to illustrate career opportunities in the region.

What is important to keep in mind is that any workforce development effort which helps to enhance the communication and interaction between industry, educational institutions and other related organizations will provide benefits to all parties. These efforts will help to enhance a region's workforce, whether it is upgrading the skills of the existing workforce or training individuals to enter the workforce.

Fostering Entrepreneurship

Entrepreneurship is typically one of the key engines of cluster growth in a region. It often helps to spark innovation since many entrepreneurs begin as individual employees of existing employers in a region who identify an unmet need or niche involving the expansion of supply chains or the tapping of new markets. These entrepreneurs may work within their employ or venture out on their own to start a business. Some entrepreneurs are also individuals who have been downsized out of larger firms and are seeking economic opportunities. In either case, these entrepreneurs typically have very good fundamental knowledge of an industry or multiple industries that form a cluster.

To take advantage of such individuals, a community or region can create an environment that will allow entrepreneurship to flourish. This may entail a variety of strategies including providing technical assistance and technical support locally or being able to effectively refer individuals and small business owners to the appropriate organizations that can meet their needs. Services for entrepreneurs may include support services and learning networks that provide

aspiring entrepreneurs with information, advice, mentoring and knowledge. Examples of support services and learning networks include a Small Business Development Center (SBDC), a local chapter of the Service Corps of Retired Executives (SCORE), the Small Business Administration (SBA) or entrepreneurial development centers, such at the John Pappajohn Entrepreneurial Centers (JPEC) in Iowa. Entrepreneurial development in rural areas can access many of these services virtually through the MyEntreNet, a program of UNI's Regional Business Center.

Financial assistance is another important feature that can be provided locally or regionally through an "angel investor" network or seed capital fund. Funding assistance may range from funding initial research and development to expanded product development to working capital. At least four community-based angel funds have been created in Iowa in the past few months. The challenge for policy makers, economic development organizations and other fund providers is to be patient when funding is provided since the time horizon from initial research and development to full commercialization for some products or services can take many years.

Some communities and regions have established business incubators that are cluster-focused. Incubators provide entrepreneurs with low-cost shared space and, more importantly, technical services. Hands-on technical assistance is provided to the tenants as they attempt to grow their businesses. An incubator's environment encourages interaction, knowledge spillover and technology transfer among start-ups. Incubators which focus on specific industry clusters limit tenants to specific businesses that complement or interact with each other or use similar technology and will complement and enhance the region's existing clusters. Examples include life science and information incubators and accelerators associated with Iowa's Regent Universities, as well as the Emerging Growth Group, which is a privately-held incubator located in Des Moines.

Marketing a Cluster

Developing a brand for a community or region has become a popular economic development marketing strategy. A successful cluster helps to facilitate branding efforts since it develops an image or identity. The most successful regions with clusters, such as Silicon Valley, Boston's Route 128 and Austin, have created an identity or brand for themselves due to the recognition of the clusters that have developed within the regions.

The presence of an industry cluster does provide an opportunity to promote a region both internally and externally. Internal audiences are area businesses, workers and residents. It is important to raise their awareness about the regional economic base, industry linkages, key employers and institutions which make up and support the industry cluster and cluster-based economic development efforts. External audiences can include targeted industries, potential new residents/workers and potential customers for cluster firms. An example of a strategy for promoting a cluster to existing and potential cluster customers and firms are the furniture shows held in North Carolina each year that showcase the state's furniture clusters.

If a community or region is going to proactively recruit industry, then it should target industries that can complement existing industries in the cluster or provide support services or complement the labor market. The cluster framework using, the benchmark value-chain clusters, technology clusters and labor clusters illustrated in the previous section, provide a straightforward approach for identifying cluster presence and gaps that might be suitable targets for recruitment. If the recruitment effort is built around an industry cluster or clusters, then marketing materials should be developed that highlight the cluster's characteristics and benefits, such as its geography, major employers and key support institutions, the availability of skilled labor, industrial linkages and proximity to markets.

Policy and Funding for Programs and Services to Support Clusters

Where an industry cluster is in its life cycle or stage of development may determine how public and private investments and strategies should be focused because each cluster has different needs at different stages of their development. Early in an industry cluster's development, the focus is on infrastructure development such as information technologies or other physical infrastructure that can foster expanded development. Funding may also be focused on new business start-ups and entrepreneurs within a fledgling industry cluster. Another early stage strategy might focus on workforce development to expand the region's available labor pool. A third early stage approach might focus on linking firms with university-based research and development efforts or commercialization of research and development that has been developed on university campuses by networking researchers and firms (Maggioni, 2002; Swann, 1998; Temple, 1998). A region may focus on one of these approaches or use a multi-faceted approach working in each of these areas.

As a cluster matures, policies and funding efforts might focus on assisting firms and industries with new product development or new market development to remain innovative and competitive. Funding may also be needed to help firms modernize to adopt new technologies or processes that have been developed. Other efforts might focus on assisting workers to upgrade their skills and knowledge for changes within their industries or to acquire new skills that will enable them to gain employment in newer industries that are growing in the region.

Whether in the early stages of development or at a mature stage, public and private resources can be used to foster the cooperation and collaboration among firms and organizations. Matching funds could be provided in the region to firms and organizations to support cluster-based associations or consortiums, to offer joint workforce training or to develop shared facilities or technology which otherwise would not have been available in the region.

Public policy and public and private funding also play critical roles in making broader quality of life investments which impact overall economic development and specific industry cluster development. Richard Florida's research has already been cited several times in this report. His key point is that with the rise of a "creative class," communities and regions that will be successful are places where people will want to live, and in the new economy the jobs will follow the people rather than the people following the jobs. Therefore, quality of life issues such as funding for schools, available health care, affordable and available housing, quality parks and recreation and entertainment opportunities are all important total community products for communities and regions (see also Salvesen and Renski, 2002). These can provide insight into where a community or region has its priorities and what its future might be.

Summary of Key Factors for Consideration

This report has provided an overview of industry clusters and highlighted the characteristics of clusters and reasons why industries organize and locate in clusters. The challenges faced by researchers, economic development professionals and others related to identifying and quantifying industry clusters in a region were reviewed and discussed. These challenges often hamper the efforts of economic development organizations and local and state governments to development and implement cluster-based economic development strategies and programs since the degree of clustering is not clearly understood and the dynamics of inter-firm relationships are not identified. A lack of knowledge and understanding can limit the degree of

commitment necessary by a community or region to fully engage or truly embrace cluster-based economic development strategies.

Within this report a framework for applied regional cluster analysis, developed by researchers at the University of North Carolina and the University of Vienna, has been applied to identify the benchmark value-chain industry clusters, the benchmark technology clusters and the benchmark labor clusters. The largest clusters within the individual cluster types were analyzed in great depth and compared to the cluster's structure at the U.S. level.

A variety of potential economic development strategies and issues related to implementing cluster-based development were reviewed and discussed. The literature and U.S. and international experiences demonstrate that cluster-based economic development strategies require an active and strong partnership between the private sector and the public sector. Most cluster-based strategies require communication, cooperation and collaboration at a regional level between economic development organizations, elected and government officials, educational institutions and other agencies that assist firms and workers. Such a level of cooperation and collaboration requires the breaking down of many historical barriers, such as community and institutional competition and government bureaucratic red tape and non-action. Ultimately, if cluster-based economic development is to be successfully implemented in a community and region, it requires broad support, buy-in and a long-term commitment from the public and private sectors.

What follows are observations and suggestions the Institute for Decision Making has developed as part of the Community Vitality Center project for economic development officials and policy makers to consider.

- Cluster Strategies Require Strong Private Sector Participation and Leadership – As previously described, the private sector often serve as the catalyst for cluster development. Government agencies and public policy can help to foster conditions that allow for cluster development, however, progress will largely be contingent upon the commitment and openness of the private sector.
- Flexibility is Key – Due to the unique nature and geography of each industry cluster, it is important that economic development programming at the state, regional and local levels be flexible in determining and meeting the needs of firms and industries. An example of the degree of flexibility could be one community college offering a short-term workforce

training program or a new degree program across several community college districts, or two Regent universities partnering with several firms to fund joint research or training for a specific value-chain cluster, with one Regent university conducting technical or scientific research and one conducting market research.

- Be Aware of Cluster Life Cycles – As a continuation of the previous recommendation, cluster-based strategies and programming must be flexible and take into consideration the life cycle of clusters and their respective industries and workforces. A cluster that is in early development and growth stages will require different assistance programs and services, such as research and development facilities and commercialization assistance, than a mature cluster which requires modernization assistance and workforce retraining programs.
- Assist Communities/Regions Identify and Understand Clusters – For cluster-based development to be successful, economic development organizations must clearly understand the existing industry linkages and relationships that exist or could exist within their region. More extensive research and technical assistance can be provided to help local and regional economic development organizations identify and develop an understanding of clusters which have a presence in Iowa and in their regions, as well as emerging clusters which are just developing and clusters which may have growth potential in Iowa.
- Comprehensive Existing Industry Programming is Critical –All local, regional and state level cluster-based development efforts should build on a strong existing industry program. Activities can include existing industry surveys, business call programs, the development of cluster councils or workforce training consortiums. Such programming helps to build relationships between firms, service providers and other key organizations. They help to facilitate information gathering and information flow about cluster-related needs, issues, trends and gaps. However, simply collecting the data is only party of the equation. Developers need to define how collected data will be analyzed and distributed. Maintaining confidentiality while building trust and collaboration within the cluster will be a continual balancing act for developers interacting with all parties.
- "Critical Mass" of Industry is Limited, Therefore Labor is Critical – A review of the literature shows that the concentration of skilled, semi-skilled and low-skilled workers is typically a critical factor for firm clustering. The three pilot regional cluster studies completed as part of this project illustrate that in much of Iowa there are few significant

industry concentrations. Therefore, cluster-based development strategies should focus on both industry concentrations and labor clusters and determine what industries match Iowa's existing workforce skills and what new skills will be required in the future. Economic development officials may find a skilled workforce easier to grow than growing a new industry cluster. Innovative programs designed to teach students advanced skills that capture the attention of students, parents, educators and employers can be undertaken with school districts, community colleges and four-year colleges/universities. Since advanced workplace skills are transferable to a variety of employers, existing employers outside of the cluster may benefit from the strengthened workforce, even though the long-term focus of the project is on specific clusters.

- Cluster-Based Development Requires Patience and a Holistic Approach – Efforts to strengthen and grow clusters within a region or the state should take a holistic approach, not just business attraction. Cluster-based development should encompass business retention and expansion, entrepreneurship, cluster infrastructure development, workforce development, technology development, public and private research and development, and community and quality of life development. The services provided to firms within and across clusters may vary from exporting assistance to marketing and market research assistance to product testing and production modernization assistance.
- Build Capacity and Knowledge – The willingness of economic developers and government officials to invest time and resources to expand their own knowledge base, conduct research and engage in continual evaluations related to their cluster-based economic development efforts will be a hallmark of successful programs. It is unlikely that cluster-based initiatives primarily driven by a desire to market a community or region in a new/popular way will have the longevity necessary to achieve measurable success. It is also important for economic development organizations to remain objective and open when considering their region's clusters. Some economic developers may find that a cluster everyone assumes exists does not or is more fragile or declining and volatile than anticipated. It will be their responsibility to ground the new efforts in reality or redirect strategies that are inappropriate.
- Contingency & Succession Planning – Again, existing industry programming is the fundamental component of all cluster-based strategies. Therefore, part of that strategy should address contingency planning for how to respond to and manage immediate and dramatic

changes impacting a cluster or several clusters. The relocation or closing of businesses anchoring a cluster or key local suppliers may send shock waves throughout the entire cluster region. Economic developers and government officials will rely on the close relationships and communication network established with cluster firms and support organizations. This may involve having emergency meetings with firm managers and business owners prior to public disclosure or to reassure them of the community's or region's commitment to cluster-based development and their firms, and to get feedback, ideas and input on moving forward.

Succession plans to build the knowledge levels and capacity of new economic developers, elected officials and new policy makers should also be organized and implemented as cluster-based economic develop strategies are undertaken. The fact is, businesses and industries within the state are often more constant than those attempting to serve them. To be successful, a cluster-based strategy must be able to weather changes in economic development officials and political administrations. Businesses are, and will be, highly critical of the public sector if they believe that they repeatedly have to start over or be redirected by a "flavor of the day" approach to cluster-based development or any economic development policy. The public sector should put in place whatever education and training protocols are necessary to ensure a seamless transition to insure continuation and continuity related to local, regional and state cluster-based economic development programming. Communication and vital relationships quickly erode in times of change, crisis or controversy. Without adequate preparation, these networks may be difficult or impossible to maintain or rebuild.

- Research the Competition and Benchmark Progress – It should be clear to all that cluster-based development is not restricted to Iowa. This is especially true when one considers the significant number of border communities in Iowa that are in sub-regional economies that sprawl across state lines. Iowa's developers and government agencies must continually research the configurations, linkages and programs of clusters throughout the U.S. and the world. Through site visits, evaluations and long-term networking, Iowa will be forced to measure its progress and improve its efforts to match and exceed that of competitors.

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Appendix A

Benchmark Value-Chain Industry Clusters

Metalworking and Industrial Machinery

SIC	Description
2514	Metal household furniture
2522	Office furniture, except wood
2542	Partitions and fixtures, except wood
2591	Drapery hardware & blinds & shades
2599	Furniture and fixtures, nec
3053	Gaskets, packing and sealing devices
3255	Clay refractories
3272	Concrete products, nec
3274	Lime
3312	Blast furnaces and steel mills
3313	Electrometallurgical products
3315	Steel wire and related products
3316	Cold finishing of steel shapes
3317	Steel pipe and tubes
3321	Gray and ductile iron foundries
3322	Malleable iron foundries
3324	Steel investment foundries
3325	Steel foundries, nec
3398	Metal heat treating
3411	Metal cans
3412	Metal barrels, drums, and pails
3421	Cutlery
3423	Hand and edge tools, nec
3425	Saw blades and handsaws
3429	Hardware, nec
3431	Metal sanitary ware
3433	Heating equipment, except electric
3441	Fabricated structural metal
3442	Metal doors, sash, and trim
3443	Fabricated plate work (boiler shops)
3444	Sheet metalwork
3446	Architectural metal work
3448	Prefabricated metal buildings
3449	Miscellaneous metal work
3451	Screw machine products
3452	Bolts, nuts, rivets, and washers
3462	Iron and steel forgings
3465	Automotive stampings
3466	Crowns and closures
3469	Metal stampings, nec
3471	Plating and polishing
3479	Metal coating and allied services
3483	Ammunition, exc. for small arms, nec
3484	Small arms
3489	Ordnance and accessories, nec
3491	Industrial valves
3492	Fluid power valves & hose fittings
3493	Steel springs, except wire
3494	Valves and pipe fittings, nec
3495	Wire springs
3496	Misc. fabricated wire products
3498	Fabricated pipe and fittings
3499	Fabricated metal products, nec
3511	Turbines and turbine generator sets
3519	Internal combustion engines, nec
3523	Farm machinery and equipment
3524	Lawn and garden equipment
3531	Construction machinery
3532	Mining machinery
3533	Oil and gas field machinery
3534	Elevators and moving stairways
3535	Conveyors and conveying equipment
3536	Hoists, cranes, and monorails
3537	Industrial trucks and tractors
3541	Machine tools, metal cutting types
3542	Machine tools, metal forming types
3543	Industrial patterns
3544	Special dies, tools, jigs & fixtures
3545	Machine tool accessories
3546	Power-driven handtools
3547	Rolling mill machinery
3548	Welding apparatus .
3549	Metalworking machinery, nec
3552	Textile machinery
3553	Woodworking machinery
3554	Paper industries machinery
3555	Printing trades machinery
3556	Food products machinery
3559	Special industry machinery, nec
3561	Pumps and pumping equipment
3562	Ball and roller bearings
3563	Air and gas compressors
3564	Blowers and fans
3565	Packaging machinery
3566	Speed changers, drives, and gears
3567	Industrial furnaces and ovens

3568	Power transmission equipment, nec
3569	General industrial machinery, nec
3581	Automatic vending machines
3582	Commercial laundry equipment
3585	Refrigeration and heating equipment
3586	Measuring and dispensing pumps
3589	Service industry machinery, nec
3592	Carburetors, pistons, rings, valves
3593	Fluid power cylinders & actuators
3594	Fluid power pumps and motors
3599	Industrial machinery, nec
3612	Transformers, except electronic
3613	Switchgear and switchboard apparatus
3621	Motors and generators
3624	Carbon and graphite products
3631	Household cooking equipment
3632	Household refrigerators and freezers
3633	Household laundry equipment
3634	Electric housewares and fans
3639	Household appliances, nec
3643	Current carrying wiring devices
3644	Noncurrent carrying wiring devices
3692	Primary batteries, dry and wet
3713	Truck and bus bodies
3714	Motor vehicle parts and accessories
3715	Truck trailers
3731	Ship building and repairing
3732	Boat building and repairing
3743	Railroad equipment
3751	Motorcycles, bicycles, and parts
3795	Tanks and tank components
3821	Laboratory apparatus and furniture
3949	Sporting and athletic goods, nec
3995	Burial caskets

Packaged Food Products

SIC	Description
2011	Meat packing plants
2013	Sausages and other prepared meats
2015	Poultry slaughtering and processing
2021	Creamery butter
2022	Cheese, natural and processed
2023	Dry, condensed, evaporated products
2024	Ice cream and frozen desserts
2026	Fluid milk
2032	Canned specialties
2033	Canned fruits and vegetables
2034	Dehydrated fruits, vegetables, soups
2035	Pickles, sauces, and salad dressings
2037	Frozen fruits and vegetables
2038	Frozen specialties, nec
2043	Cereal breakfast foods
2044	Rice milling
2045	Prepared flour mixes and doughs
2051	Bread, cake, and related products
2052	Cookies and crackers
2053	Frozen bakery products, except bread
2061	Raw cane sugar
2062	Cane sugar refining
2063	Beet sugar
2064	Candy & other confectionaries
2066	Chocolate and cocoa products
2067	Chewing gum
2068	Salted and roasted nuts and seeds
2079	Edible fats and oils, nec
2082	Malt beverages
2084	Wines, brandy, and brandy spirits
2085	Distilled and blended liquors
2086	Bottled and canned soft drinks
2091	Canned and cured fish and seafoods
2092	Fresh or frozen prepared fish
2095	Roasted coffee
2096	Potato chips and similar snacks
2098	Macaroni and spaghetti
2099	Food preparations, nec
2676	Sanitary paper products
2861	Gum and wood chemicals
3262	Vitreous china table & kitchenware
3263	Semivitreous table & kitchenware
3556	Food products machinery
3565	Packaging machinery
3914	Silverware and plated ware

Construction Materials

SIC	Description
2273	Carpets and rugs
2394	Canvas and related products
2421	Sawmills and planing mills, general
2426	Hardwood dimension & flooring mills
2429	Special product sawmills, nec
2431	Millwork
2434	Wood kitchen cabinets
2435	Hardwood veneer and plywood
2436	Softwood veneer and plywood
2439	Structural wood members, nec
2452	Prefabricated wood buildings

2491	Wood preserving
2493	Reconstituted wood products
2499	Wood products, nec
2541	Wood partitions and fixtures
2679	Converted paper products, nec
2851	Paints, varnishes, lacquers, enamels, etc.
2951	Asphalt paving mixtures and blocks
2952	Asphalt felts and coatings
3251	Brick and structural clay tile
3253	Ceramic wall and floor tile
3259	Structural clay products, nec
3261	Vitreous plumbing fixtures
3264	Porcelain electrical supplies
3271	Concrete block and brick
3273	Ready-mixed concrete
3275	Gypsum products
3281	Cut stone and stone products
3291	Abrasive products
3296	Mineral wool
3315	Steel wire and related products
3357	Nonferrous wiredrawing & insulating
3425	Saw blades and handsaws
3431	Metal sanitary ware
3432	Plumbing fixture fittings and trim
3433	Heating equipment, except electric
3442	Metal doors, sash, and trim
3444	Sheet metalwork
3449	Miscellaneous metal work
3491	Industrial valves
3492	Fluid power valves & hose fittings
3494	Valves and pipe fittings, nec
3495	Wire springs
3496	Misc. fabricated wire products
3498	Fabricated pipe and fittings
3561	Pumps and pumping equipment
3563	Air and gas compressors
3585	Refrigeration and heating equipment
3586	Measuring and dispensing pumps
3613	Switchgear and switchboard apparatus
3634	Electric housewares and fans
3639	Household appliances, nec
3643	Current-carrying wiring devices
3644	Noncurrent-carrying wiring devices
3645	Residential lighting fixtures
3646	Commercial lighting fixtures
3647	Vehicular lighting equipment
3648	Lighting equipment, nec
3663	Radio & TV communications equipment
3669	Communications equipment, nec
3699	Electrical equipment & supplies, nec
3799	Transportation equipment, nec
3822	Environmental controls
3851	Ophthalmic goods
3991	Brooms and brushes
3996	Hard surface floor coverings, nec
8711	Engineering services
8712	Architectural services
8713	Surveying services

Printing and Publishing

SIC	Description
2611	Pulp mills
2652	Setup paperboard boxes
2653	Corrugated and solid fiber boxes
2655	Fiber cans, drums & similar products
2656	Sanitary food containers
2657	Folding paperboard boxes
2671	Paper coated & laminated, packaging
2672	Paper coated and laminated, nec
2673	Bags: plastics, laminated, & coated
2674	Bags: uncoated paper & multiwall
2675	Die-cut paper and board
2676	Sanitary paper products
2677	Envelopes
2678	Stationery products
2679	Converted paper products, nec
2711	Newspapers: publishing, or pub. & printing
2721	Periodicals: publishing and printing
2731	Book publishing
2732	Book printing
2741	Miscellaneous publishing
2752	Commercial printing, lithographic
2754	Commercial printing, gravure
2759	Commercial printing, nec
2761	Manifold business forms
2771	Greeting cards
2782	Blankbooks and looseleaf binders
2789	Bookbinding and related work
2791	Typesetting
2796	Platemaking services
3275	Gypsum products
3861	Photographic equipment and supplies
3953	Marking devices
3955	Carbon paper and inked ribbons
3993	Signs and advertising specialities
3999	Manufacturing industries, nec

4812	Radiotelephone communications
4813	Telephone communications, exc. radio
4822	Telegraph & other message communications
4899	Communications services, nec
7371	Computer programming services
7372	Prepackaged software
7373	Computer integrated systems design
7374	Data processing and preparation
7375	Information retrieval services
7376	Computer facilities management
7377	Computer rental & leasing
7378	Computer maintenance & repair
7379	Computer related services, nec

Information Technology and Instruments

SIC	Description
3471	Plating and polishing
3571	Electronic computers
3572	Computer storage devices
3575	Computer terminals
3577	Computer peripheral equipment, nec
3578	Calculating and accounting equipment
3579	Office machines, nec
3596	Scales and balances, exc. laboratory
3625	Relays and industrial controls
3629	Electrical industrial apparatus, nec
3651	Household audio and video equipment
3661	Telephone and telegraph apparatus
3663	Radio & TV communications equipment
3669	Communications equipment, nec
3672	Printed circuit boards
3674	Semiconductors and related devices
3675	Electronic capacitors
3676	Electronic resistors
3677	Electronic coils and transformers
3678	Electronic connectors
3679	Electronic components, nec
3694	Engine electrical equipment
3699	Electrical equipment & supplies, nec
3728	Aircraft parts and equipment, nec
3761	Guided missiles and space vehicles
3769	Space vehicle equipment, nec
3812	Search and navigation equipment
3821	Laboratory apparatus and furniture
3822	Environmental controls
3823	Process control instruments
3824	Fluid meters and counting devices
3825	Instruments to measure electricity
3826	Analytical instruments
3827	Optical instruments and lenses
3829	Measuring & controlling devices, nec
3841	Surgical and medical instruments
3844	X-ray apparatus and tubes
3845	Electromedical equipment
3861	Photographic equipment and supplies
3873	Watches, clocks, watchcases and parts
3931	Musical instruments
7371	Computer programming services
7372	Prepackaged software
7373	Computer integrated systems design
7374	Data processing and preparation
7375	Information retrieval services
7376	Computer facilities management
7377	Computer rental & leasing
7378	Computer maintenance & repair
7379	Computer related services, nec

Chemicals and Plastics

SIC	Description
2087	Flavoring extracts and syrups, nec
2611	Pulp mills
2621	Paper mills
2631	Paperboard mills
2812	Alkalies and chlorine
2813	Industrial gases
2816	Inorganic pigments
2821	Plastics materials and resins
2822	Synthetic rubber
2823	Cellulosic manmade fibers
2824	Organic fibers, noncellulosic
2841	Soap and other detergents
2842	Polishes and sanitation goods
2843	Surface active agents
2851	Paints, varnishes, lacquers, enamels, etc.
2865	Cyclic crudes and intermediates
2869	Industrial organic chemicals, nec
2875	Fertilizers, mixing only
2879	Agricultural chemicals, nec
2891	Adhesives and sealants
2893	Printing ink
2899	Chemical preparations, nec
3011	Tires and inner tubes
3061	Mechanical rubber goods
3069	Fabricated rubber products, nec
3081	Unsupported plastics film & sheet
3082	Unsupported plastics profile shapes

3083	Laminated plastics plate & sheet
3084	Plastics pipe
3085	Plastics bottles
3086	Plastics foam products
3087	Custom compound purchased resins
3088	Plastics plumbing fixtures
3089	Plastics products, nec
3111	Leather tanning and finishing
3291	Abrasive products
3399	Primary metal products, nec
3559	Special industry machinery, nec
3692	Primary batteries, dry and wet
3996	Hard surface floor coverings, nec
8042	Offices and clinics of optometrists
8043	Offices and clinics of podiatrists
8049	Offices of health practitioners, nec
8071	Medical laboratories
8072	Dental laboratories
8092	Kidney dialysis centers
8093	Specialty outpatient facilities, nec
8099	Health and allied services, nec

Apparel

SIC	Description
2211	Broadwoven fabric mills, cotton
2221	Broadwoven fabric mills, manmade
2231	Broadwoven fabric mills, wool
2241	Narrow fabric and other smallwares mills
2251	Women's hosiery, except socks
2252	Hosiery, nec
2253	Knit outerwear mills
2254	Knit underwear mills
2257	Weft knit fabric mills
2258	Lace & warp knit fabric mills
2259	Knitting mills, nec
2261	Finishing plants, cotton
2262	Finishing plants, manmade
2269	Finishing plants, nec
2273	Carpets and rugs
2281	Yarn spinning mills
2282	Throwing and winding mills
2284	Thread mills
2296	Tire cord and fabrics
2297	Nonwoven fabrics
2298	Cordage and twine
2299	Textile goods, nec
2311	Men's and boys' suits, coats and overcoats
2321	Men's and boys' shirts
2322	Men's & boys' underwear and nightwear
2323	Men's and boys' neckwear
2325	Men's and boys' trousers and slacks
2326	Men's and boys' work clothing
2329	Men's and boys' clothing, nec
2331	Women's & misses' blouses & shirts
2335	Women's, junior's, & misses' dresses
2337	Women's and misses' suits and coats
2339	Women's and misses' outerwear, nec
2341	Women's and children's underwear
2342	Bras, girdles, and allied garments
2353	Hats, caps, and millinery
2361	Girls' & children's dresses, blouses
2369	Girls' and children's outerwear, nec
2371	Fur goods
2381	Fabric dress and work gloves
2384	Robes and dressing gowns
2385	Waterproof outerwear
2386	Leather and sheep-lined clothing
2387	Apparel belts
2389	Apparel and accessories, nec
2395	Pleating and stitching
2397	Schiff li machine embroideries
2824	Organic fibers, noncellulosic
3965	Fasteners, buttons, needles, & pins

Motor Vehicle Manufacturing

SIC	Description
2273	Carpets and rugs
2299	Textile goods, nec
2396	Automotive and apparel trimmings
2399	Fabricated textile products, nec
2531	Public building and related furniture
2599	Furniture and fixtures, nec
2851	Paints, varnishes, lacquers, enamels, etc.
2891	Adhesives and sealants
3011	Tires and inner tubes
3052	Rubber & plastics hose & belting
3061	Mechanical rubber goods
3069	Fabricated rubber products, nec
3081	Unsupported plastics film & sheet
3082	Unsupported plastics profile shapes
3083	Laminated plastics plate & sheet
3084	Plastics pipe
3085	Plastics bottles
3086	Plastics foam products
3087	Custom compound purchased resins
3088	Plastics plumbing fixtures

3089	Plastics products, nec
3142	House slippers
3211	Flat glass
3229	Pressed and blown glass, nec
3231	Glass products, made of purchased glass
3465	Automotive stampings
3493	Steel springs, except wire
3519	Internal combustion engines, nec
3524	Lawn and garden equipment
3585	Refrigeration and heating equipment
3592	Carburetors, pistons, rings, valves
3641	Electric lamps
3651	Household audio and video equipment
3694	Engine electrical equipment
3711	Motor vehicles and car bodies
3713	Truck and bus bodies
3714	Motor vehicle parts and accessories
3715	Truck trailers
3716	Motor homes

Fabricated Textiles

SIC	Description
2211	Broadwoven fabric mills, cotton
2221	Broadwoven fabric mills, manmade
2231	Broadwoven fabric mills, wool
2261	Finishing plants, cotton
2262	Finishing plants, manmade
2295	Coated fabrics, not rubberized
2311	Men's and boys' suits, coats and overcoats
2321	Men's and boys' shirts
2322	Men's & boys' underwear + nightwear
2323	Men's and boys' neckwear
2325	Men's and boys' trousers and slacks
2326	Men's and boys' work clothing
2329	Men's and boys' clothing, nec
2331	Women's & misses' blouses & shirts
2335	Women's, junior's, & misses' dresses
2337	Women's and misses' suits and coats
2339	Women's and misses' outerwear, nec
2341	Women's and children's underwear
2342	Bras, girdles, and allied garments
2353	Hats, caps, and millinery
2361	Girls' & children's dresses, blouses
2369	Girls' and children's outerwear, nec
2371	Fur goods
2381	Fabric dress and work gloves
2384	Robes and dressing gowns
2385	Waterproof outerwear
2386	Leather and sheep□lined clothing
2387	Apparel belts
2389	Apparel and accessories, nec
2391	Curtains and draperies
2392	Housefurnishings, nec
2393	Textile bags
2394	Canvas and related products
2396	Automotive and apparel trimmings
2399	Fabricated textile products, nec
2512	Upholstered household furniture
2515	Mattresses and bedsprings
2823	Cellulosic manmade fibers
3021	Rubber and plastics footwear
3052	Rubber & plastics hose & belting
3161	Luggage
3172	Personal leather goods, nec
3842	Surgical appliances and supplies
3942	Dolls and stuffed toys
3965	Fasteners, buttons, needles, & pins
3995	Burial caskets

Stone, Clay and Glass Products

SIC	Description
2873	Nitrogenous fertilizers
2874	Phosphatic fertilizers
2911	Petroleum refining
3011	Tires and inner tubes
3241	Cement, hydraulic
3255	Clay refractories
3261	Vitreous plumbing fixtures
3262	Vitreous china table & kitchenware
3263	Semivitreous table & kitchenware
3264	Porcelain electrical supplies
3269	Pottery products, nec
3274	Lime
3295	Minerals, ground or treated
3297	Nonclay refractories
3299	Nonmetallic mineral products, nec
3629	Electrical industrial apparatus, nec

Wood Products and Furniture

SIC	Description
2411	Logging
2426	Hardwood dimension & flooring mills
2431	Millwork
2434	Wood kitchen cabinets
2439	Structural wood members, nec
2441	Nailed wood boxes and shook

2448	Wood pallets and skids
2449	Wood containers, nec
2451	Mobile homes
2452	Prefabricated wood buildings
2493	Reconstituted wood products
2499	Wood products, nec
2511	Wood household furniture
2517	Wood TV and radio cabinets
2521	Wood office furniture
2611	Pulp mills
2621	Paper mills
2631	Paperboard mills
2861	Gum and wood chemicals
3792	Travel trailers and campers
3931	Musical instruments

Primary Nonferrous Metals

SIC	Description
3321	Gray and ductile iron foundries
3322	Malleable iron foundries
3324	Steel investment foundries
3325	Steel foundries, nec
3331	Primary copper
3339	Primary nonferrous metals, nec
3351	Copper rolling and drawing
3356	Nonferrous rolling and drawing, nec
3363	Aluminum die-castings
3364	Nonferrous die-casting exc. aluminum
3365	Aluminum foundries
3366	Copper foundries
3369	Nonferrous foundries, nec
3399	Primary metal products, nec
3599	Industrial machinery, nec

Leather Goods

SIC	Description
3111	Leather tanning and finishing
3131	Boot and shoe cut stock and findings
3142	House slippers
3143	Men's footwear, except athletic
3144	Women's footwear, except athletic
3149	Footwear, except rubber, nec
3151	Leather gloves and mittens
3171	Women's handbags and purses
3172	Personal leather goods, nec
3199	Leather goods, not elsewhere classified

Tobacco Products

SIC	Description
2111	Cigarettes
2121	Cigars
2131	Chewing and smoking tobacco
2141	Tobacco stemming and redrying

Canned and Bottled Beverages

SIC	Description
2046	Wet corn milling
2047	Dog and cat food
2048	Prepared feeds, nec
2083	Malt
2087	Flavoring extracts and syrups, nec
2873	Nitrogenous fertilizers
2874	Phosphatic fertilizers
2875	Fertilizers, mixing only
2879	Agricultural chemicals, nec
3221	Class containers
3411	Metal cans

Fat Oil Mills

SIC	Description
2074	Cottonseed oil mills
2075	Soybean oil mills
2076	Vegetable oil mills, nec
2077	Animal and marine fats and oils
2079	Edible fats and oils, nec

Aerospace

SIC	Description
3463	Nonferrous forgings
3482	Small arms ammunition
3483	Ammunition, exc. for small arms, nec
3721	Aircraft
3724	Aircraft engines and engine parts
3728	Aircraft parts and equipment, nec
3761	Guided missiles and space vehicles
3764	Space propulsion units and parts
3769	Space vehicle equipment, nec
3812	Search and navigation equipment

Petroleum Products

SIC	Description
2895	Carbon black
2911	Petroleum refining
2951	Asphalt paving mixtures and blocks
2952	Asphalt felts and coatings
2992	Lubricating oils and greases

2999	Petroleum and coal products, nec

Jewelry

SIC	Description
3339	Primary nonferrous metals, nec
3911	Jewelry, precious metal
3915	Jewelers' materials & lapidary work
3961	Costume jewelry

Boat Building

SIC	Description
3732	Boat building and repairing
3543	Industrial patterns
3541	Machine tools, metal cutting types
3519	Internal combustion engines, nec
3511	Turbines and turbine generator sets

Aluminum

SIC	Description
2819	Industrial inorganic chemicals, nec
3334	Primary aluminum
3353	Aluminum sheet, plate, and foil
3354	Aluminum extruded products
3355	Aluminum rolling and drawing, nec
3411	Metal cans
3463	Nonferrous forgings
3497	Metal foil and leaf

Hospitals, Labs, Specialized Medical Services

SIC	Description
2731	Book publishing
7371	Computer programming services
7372	Prepackaged software
7373	Computer integrated systems design
7374	Data processing and preparation
7375	Information retrieval services
7376	Computer facilities management
7377	Computer rental & leasing
7378	Computer maintenance & repair
7379	Computer related services, nec
8042	Offices and clinics of optometrists
8043	Offices and clinics of podiatrists
8049	Offices of health practitioners, nec
8062	General medical and surgical hospitals
8063	Psychiatric hospitals
8069	Specialty hospitals, except psychiatric
8071	Medical laboratories
8072	Dental laboratories
8092	Kidney dialysis centers
8093	Specialty outpatient facilities, nec
8099	Health and allied services, nec
8731	Commercial physical research
8732	Commercial nonphysical research
8734	Testing laboratories

Platemaking and Typesetting

SIC	Description
2791	Typesetting
2796	Platemaking services
2893	Printing ink
3555	Printing trades machinery

Securities and Insurance

SIC	Description
6231	Security and commodity exchanges
6282	Investment advice
6289	Security and commodity exchange nec
6311	life insurance
6321	Accident and health insurance
6324	Hospital and medical service plans
6351	Surety insurance
6361	Title insurance
6371	Pension, health, and welfare funds
6399	Insurance carriers, nec
6531	Real estate agents and managers

Banking and Advertising

SIC	Description
6011	Federal reserve banks
6019	Central reserve depository institutions, nec
6021	National commercial banks
6022	State commercial banks
6029	Commercial banks, nec
6035	Savings institutions, Federally chartered
6036	Savings institutions, not Federally chartered
6061	Credit unions, Federally chartered
6062	Credit unions, not Federally chartered
6081	Branched and agencies of foreign banks
6082	Foreign trade & intl. banking institutions
6091	Nondeposit trust facilities
6099	Functions related to depository banking, nec
6111	Federal and Fed.-sponsored credit
6141	Personal credit institutions
6153	Short-term bus. credit institutions, exc. ag
6159	Misc. business credit institutions
6162	Mortgage bankers and loan correspondents

6163	Loan Brokers
6211	Security brokers, dealers, & flotation co
6221	Commodity contracts brokers and dealers
7311	Advertising agencies
7312	Outdoor advertising services
7313	Radio, TV, publisher representatives
7319	Advertising, nec

Legal Services

SIC	Description
8111	Legal services

Transportation, Shipping, & Logistics

SIC	Description
4212	Local Trucking without Storage
4213	Trucking, except local
4214	Local Trucking with Storage
4215	Courier Services, except Air
4221	Farm product warehousing and storage
4222	Refrigerated warehousing and storage
4225	General warehousing and storage
4226	Special warehousing and storage, nec
4231	Trucking terminal facilities
4311	U.S. Postal Service
4412	Deep sea foreign transportation of freight
4424	Deep sea domestic transportation of freight
4432	Freight trans. on Great Lakes - St. Lawrence
4449	Water transport of freight, nec
4481	Deep sea passenger trans., ex. ferry
4482	Ferries
4489	Water passenger transportation, nec
4491	Marine cargo handling
4492	Towing and tugboat service
4493	Marinas
4499	Water transportation services, nec
4512	Air transportation, scheduled
4513	Air courier services
4522	Air transportation, nonscheduled
4612	Crude petroleum pipelines
4613	Refined petroleum pipelines
4619	Pipelines, nec
4731	Freight transportation arrangement
4741	Rental of railroad cars
4783	Packing and crating
4785	Vehicle inspection and weighing services
4789	Transportation services, nec

Pharmaceuticals

SIC	Description
2833	Medicinals and botanicals
2834	Pharmaceutical preparations
2835	Diagnostic substances
2836	Biological products exc. diagnostic

Source: Edward .J. Feser, Associate Professor, Department of City and Regional Planning, University of North Carolina – Chapel Hill (2003)

Appendix B

Benchmark Technology-Intensive Clusters

Chemicals and Plastics

SIC	Description
2812	Alkalies and chlorine
2813	Industrial gases
2816	Inorganic pigments
2821	Plastics materials and resins
2822	Synthetic rubber
2823	Cellulosic manmade fibers
2824	Organic fibers, noncellulosic
2841	Soap and other detergents
2842	Polishes and sanitation goods
2843	Surface active agents
2844	Toilet preparations
2851	Paints, varnishes, lacquers, enamels, etc.
2865	Cyclic crudes and intermediates
2869	Industrial organic chemicals, nec
2873	Nitrogenous fertilizers
2874	Phosphatic fertilizers
2875	Fertilizers, mixing only
2879	Agricultural chemicals, nec
2891	Adhesives and sealants
2893	Printing ink
2899	Chemical preparations, nec
3559	Special industry machinery, nec
3624	Carbon and graphite products
3692	Primary batteries, dry and wet
3843	Dental equipment and supplies
8071	Medical laboratories
8072	Dental laboratories
8092	Kidney dialysis centers
8093	Specialty outpatient facilities, nec
8099	Health and allied services, nec

Information Technology and Instruments

SIC	Description
3571	Electronic computers
3572	Computer storage devices
3575	Computer terminals
3577	Computer peripheral equipment, nec
3578	Calculating and accounting equipment
3579	Office machines, nec
3625	Relays and industrial controls
3629	Electrical industrial apparatus, nec
3631	Household cooking equipment
3643	Current-carrying wiring devices
3644	Noncurrent-carrying wiring devices
3661	Telephone and telegraph apparatus
3663	Radio & TV communications equipment
3669	Communications equipment, nec
3672	Printed circuit boards
3674	Semiconductors and related devices
3675	Electronic capacitors
3676	Electronic resistors
3677	Electronic coils and transformers
3678	Electronic connectors
3679	Electronic components, nec
3694	Engine electrical equipment
3699	Electrical equipment & supplies, nec
3812	Search and navigation equipment
3821	Laboratory apparatus and furniture
3822	Environmental controls
3823	Process control instruments
3824	Fluid meters and counting devices
3825	Instruments to measure electricity
3826	Analytical instruments
3827	Optical instruments and lenses
3829	Measuring & controlling devices, nec
3844	X-ray apparatus and tubes
3845	Electromedical equipment
7371	Computer programming services
7372	Prepackaged software
7373	Computer integrated systems design
7374	Data processing and preparation
7375	Information retrieval services
7379	Computer related services, nec

Industrial Machinery

SIC	Description
3511	Turbines and turbine generator sets
3532	Mining machinery
3535	Conveyors and conveying equipment
3536	Hoists, cranes, and monorails
3541	Machine tools, metal cutting types
3542	Machine tools, metal forming types
3546	Power-driven handtools
3547	Rolling mill machinery
3549	Metalworking machinery, nec
3553	Woodworking machinery

3555	Printing trades machinery
3556	Food products machinery
3559	Special industry machinery, nec
3561	Pumps and pumping equipment
3563	Air and gas compressors
3564	Blowers and fans
3565	Packaging machinery
3612	Transformers, except electronic
3621	Motors and generators

Motor Vehicle Manufacturing

SIC	Description
2851	Paints, varnishes, lacquers, enamels, etc.
2893	Printing ink
3519	Internal combustion engines, nec
3531	Construction machinery
3534	Elevators and moving stairways
3537	Industrial trucks and tractors
3548	Welding apparatus
3641	Electric lamps
3645	Residential lighting fixtures
3646	Commercial lighting fixtures
3647	Vehicular lighting equipment
3648	Lighting equipment, nec
3651	Household audio and video equipment
3691	Storage batteries
3694	Engine electrical equipment
3711	Motor vehicles and car bodies
3713	Truck and bus bodies
3714	Motor vehicle parts and accessories
3715	Truck trailers

Aerospace

SIC	Description
3544	Special dies, tools, jigs & fixtures
3545	Machine tool accessories
3721	Aircraft
3724	Aircraft engines and engine parts
3728	Aircraft parts and equipment, nec
8734	Testing laboratories
3761	Guided missiles and space vehicles
3764	Space propulsion units and parts
3769	Space vehicle equipment, nec

Household Appliances

SIC	Description
3632	Household refrigerators and freezers
3633	Household laundry equipment
3635	Household vacuum cleaners
3639	Household appliances, nec
3716	Motor homes

Communications Services and Software

SIC	Description
4899	Communications services, nec
7371	Computer programming services
7372	Prepackaged software
7373	Computer integrated systems design
7374	Data processing and preparation
7375	Information retrieval services
7379	Computer related services, nec
8711	Engineering services
8712	Architectural services
8713	Surveying services
8731	Commercial physical research
8732	Commercial nonphysical research
8734	Testing laboratories

Pharmaceuticals and Medical Technologies

SIC	Description
2833	Medicinals and botanicals
2834	Pharmaceutical preparations
2835	Diagnostic substances
2836	Biological products exc. diagnostic
3634	Electric housewares and fans
3841	Surgical and medical instruments
3842	Surgical appliances and supplies
8731	Commercial physical research
8732	Commercial nonphysical research

Source: Edward .J. Feser, Associate Professor, Department of City and Regional Planning, versity of North Carolina – Chapel Hill (2003)

Appendix C

Benchmark Labor Clusters

Low Skill, Non-Durable Manufacturing

2211 Broadwoven Fabric Mills, Cotton
2221 Broadwoven Fabric Mills, Manmade Fiber and Silk
2231 Broadwoven Fabric Mills, Wool (Including Dyeing and Finishing)
2241 Narrow Fabric and Other Smallware Mills: Cotton, Wool, Silk, and Manmade Fiber
2251 Women's Full-Length and Knee-Length Hosiery, Except Socks
2252 Hosiery, NEC
2253 Knit Outerwear Mills
2254 Knit Underwear and Nightwear Mills
2257 Weft Knit Fabric Mills
2258 Lace and Warp Knit Fabric Mills
2259 Knitting Mills, NEC
2261 Finishers of Broadwoven Fabrics of Cotton
2262 Finishers of Broadwoven Fabrics of Manmade Fiber and Silk
2269 Finishers of Textiles, NEC
2273 Carpets and Rugs
2281 Yarn Spinning Mills
2282 Yarn Texturizing, Throwing, Twisting, and Winding Mills
2284 Thread Mills
2295 Coated Fabrics, Not Rubberized
2296 Tire Cord and Fabrics
2297 Nonwoven Fabrics
2298 Cordage and Twine
2299 Textile Goods, NEC
2311 Men's and Boys' Suits, Coats, and Overcoats
2321 Men's and Boys' Shirts, Except Work Shirts
2322 Men's and Boys' Underwear and Nightwear
2323 Men's and Boys' Neckwear
2325 Men's and Boys' Trousers and Slacks
2326 Men's and Boys' Work Clothing
2329 Men's and Boys' Clothing, NEC
2331 Women's, Misses', and Juniors' Blouses and Shirts
2335 Women's, Misses', and Juniors' Dresses
2337 Women's, Misses' and Juniors' Suits, Skirts, and Coats
2339 Women's, Misses', and Juniors' Outerwear, NEC
2341 Women's, Misses', Children's, and Infants' Underwear and Nightwear
2342 Brassieres, Girdles, and Allied Garments
2353 Hats, Caps, and Millinery
2361 Girls', Children's, and Infants' Dresses, Blouses, and Shirts
2369 Girls', Children's, and Infants' Outerwear, NEC
2371 Fur Goods
2381 Dress and Work Gloves, Except Knit and All-Leather
2384 Robes and Dressing Gowns
2385 Waterproof Outerwear
2386 Leather and Sheep-Lined Clothing
2387 Apparel Belts
2389 Apparel and Accessories, NEC
2391 Curtains and Draperies
2392 Housefurnishings, Except Curtains and Draperies
2393 Textile Bags
2394 Canvas and Related Products
2395 Pleating, Decorative and Novelty Stitching, and Tucking for the Trade
2396 Automotive Trimmings, Apparel Findings, and Related Products
2397 Schiffli Machine Embroideries
2399 Fabricated Textile Products, NEC
2821 Plastics Material and Synthetic Resins, and Nonvulcanizable Elastomers
2822 Synthetic Rubber
2823 Cellulosic Manmade Fibers
2824 Manmade Organic Fibers, Except Cellulosic
2851 Paints, Varnishes, Lacquers, Enamels, and Allied Products
3021 Rubber and Plastics Footwear
3052 Rubber and Plastics Hose and Belting
3053 Gaskets, Packing, and Sealing Devices
3061 Molded, Extruded, and Lathe-Cut Mechanical Rubber Goods
3069 Fabricated Rubber Products, NEC
3081 Unsupported Plastics Film and Sheet
3082 Unsupported Plastics Profile Shapes
3083 Laminated Plastics Plate, Sheet, and Profile Shapes
3084 Plastics Pipe
3085 Plastics Bottles
3086 Plastics Foam Products
3087 Custom Compounding of Purchased Plastics Resins
3088 Plastics Plumbing Fixtures

3089 Plastics Products, NEC
3111 Leather Tanning and Finishing
3151 Leather Gloves and Mittens
3161 Luggage
3171 Women's Handbags and Purses
3172 Personal Leather Goods, Except Women's Handbags and Purses
3199 Leather Goods, NEC
3523 Farm Machinery and Equipment
3524 Lawn and Garden Tractors and Home Lawn and Garden Equipment
3531 Construction Machinery and Equipment
3532 Mining Machinery and Equipment, Except Oil and Gas Field Machinery and Equipment
3533 Oil and Gas Field Machinery and Equipment
3534 Elevators and Moving Stairways
3535 Conveyors and Conveying Equipment
3536 Overhead Traveling Cranes, Hoists, and Monorail Systems
3537 Industrial Trucks, Tractors, Trailers, and Stackers
3581 Automatic Vending Machines
3582 Commercial Laundry, Drycleaning, and Pressing Machines
3585 Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment
3586 Measuring and Dispensing Pumps
3589 Service Industry Machinery, NEC
3631 Household Cooking Equipment
3632 Household Refrigerators and Home and Farm Freezers
3633 Household Laundry Equipment
3634 Electric Housewares and Fans
3635 Household Vacuum Cleaners
3639 Household Appliances, NEC
3792 Travel Trailers and Campers
3795 Tanks and Tank Components
3799 Transportation Equipment, NEC
3911 Jewelry, Precious Metal
3914 Silverware, Plated Ware, and Stainless Steel Ware
3915 Jewelers' Findings and Materials, and Lapidary Work

Information Processing

4731 Arrangement of Transportation of Freight and Cargo
6311 Life Insurance
6321 Accident and Health Insurance
6324 Hospital and Medical Service Plans
6331 Fire, Marine, and Casualty Insurance
6351 Surety Insurance
6361 Title Insurance
6371 Pension, Health, and Welfare Funds
6399 Insurance Carriers, NEC
6531 Real Estate Agents and Managers
7371 Computer Programming Services
7372 Prepackaged Software
7373 Computer Integrated Systems Design
7374 Computer Processing and Data Preparation and Processing Services
7375 Information Retrieval Services
7376 Computer Facilities Management Services
7377 Computer Rental and Leasing
7378 Computer Maintenance and Repair
7379 Computer Related Services, NEC
8721 Accounting, Auditing, and Bookkeeping Services

Low Skill, Misc. Manufacturing

2011 Meat Packing Plants
2013 Sausages and Other Prepared Meats
2015 Poultry Slaughtering and Processing
2032 Canned Specialties
2033 Canned Fruits, Vegetables, Preserves, Jams, and Jellies
2034 Dried and Dehydrated Fruits, Vegetables, and Soup Mixes
2035 Pickled Fruits and Vegetables, Vegetable Sauces and Seasonings, and Salad Dressings
2037 Frozen Fruits, Fruit Juices, and Vegetables
2038 Frozen Specialties, NEC
2091 Canned and Cured Fish and Seafood
2092 Prepared Fresh or Frozen Fish and Seafoods
2095 Roasted Coffee
2096 Potato Chips, Corn Chips, and Similar Snacks
2097 Manufactured Ice
2098 Macaroni, Spaghetti, Vermicelli, and Noodles
2099 Food Preparations, NEC
2421 Sawmills and Planing Mills, General
2426 Hardwood Dimension and Flooring Mills
2429 Special Product Sawmills, NEC
2441 Nailed and Lock Corner Wood Boxes and Shook
2448 Wood Pallets and Skids
2449 Wood Containers, NEC
2499 Wood Products, NEC
2791 Typesetting

2796 Platemaking and Related Services
2841 Soaps and Other Detergents, Except Speciality Cleaners
2842 Speciality Cleaning, Polishing, and Sanitary Preparations
2843 Surface Active Agents, Finishing Agents, Sulfonated Oils, and Assistants
2844 Perfumes, Cosmetics, and Other Toilet Preparations
3142 House Slippers
3143 Men's Footwear, Except Athletic
3144 Women's Footwear, Except Athletic
3149 Footwear, Except Rubber, NEC
4412 Deep Sea Foreign Transportation of Freight
4424 Deep Sea Domestic Transportation of Freight
4432 Freight Transportation on the Great Lakes - St. Lawrence Seaway
4449 Water Transportation of Freight, NEC
4481 Deep Sea Transportation of Passengers, Except by Ferry
4482 Ferries
4489 Water Transportation of Passengers, NEC
4491 Marine Cargo Handling
4492 Towing and Tugboat Services
4493 Marinas
4499 Water Transportation Services, NEC
4783 Packing and Crating
4785 Fixed Facilities and Inspection and Weighing Services for Motor Vehicle Transportation
4789 Transportation Services, NEC

Standardized Heavy Industry

2611 Pulp Mills
2621 Paper Mills
2631 Paperboard Mills
3131 Boot and Shoe Cut Stock and Findings
3211 Flat Glass
3221 Glass Containers
3229 Pressed and Blown Glass and Glassware, NEC
3231 Glass Products, Made of Purchased Glass
3312 Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills
3313 Electrometallurgical Products, Except Steel
3315 Steel Wiredrawing and Steel Nails and Spikes
3316 Cold-Rolled Steel Sheet, Strip, and Bars
3317 Steel Pipe and Tubes
3321 Gray and Ductile Iron Foundries
3322 Malleable Iron Foundries
3324 Steel Investment Foundries
3325 Steel Foundries, NEC
3331 Primary Smelting and Refining of Copper
3334 Primary Production of Aluminum
3339 Primary Smelting and Refining of Nonferrous Metals, Except Copper and Aluminum
3341 Secondary Smelting and Refining of Nonferrous Metals
3351 Rolling, Drawing, and Extruding of Copper
3353 Aluminum Sheet, Plate, and Foil
3354 Aluminum Extruded Products
3355 Aluminum Rolling and Drawing, NEC
3356 Rolling, Drawing, and Extruding of Nonferrous Metals, Except Copper and Aluminum
3357 Drawing and Insulating of Nonferrous Wire
3363 Aluminum Die-Castings
3364 Nonferrous Die-Castings, Except Aluminum
3365 Aluminum Foundries
3366 Copper Foundries
3369 Nonferrous Foundries, Except Aluminum and Copper
3411 Metal Cans
3412 Metal Shipping Barrels, Drums, Kegs, and Pails
3421 Cutlery
3423 Hand and Edge Tools, Except Machine Tools and Handsaws
3425 Saw Blades and Handsaws
3429 Hardware, NEC
3431 Enameled Iron and Metal Sanitary Ware
3432 Plumbing Fixture Fittings and Trim
3433 Heating Equipment, Except Electric and Warm Air Furnaces
3451 Screw Machine Products
3452 Bolts, Nuts, Screws, Rivets, and Washers
3462 Iron and Steel Forgings
3463 Nonferrous Forgings
3465 Automotive Stamping
3466 Crowns and Closures
3469 Metal Stamping, NEC
3471 Electroplating, Plating, Polishing, Anodizing, and Coloring
3479 Coating, Engraving, and Allied Services, NEC
3482 Small Arms Ammunition
3483 Ammunition, Except for Small Arms
3484 Small Arms
3489 Ordnance and Accessories, NEC
3491 Industrial Valves
3492 Fluid Power Valves and Hose Fittings
3493 Steel Springs, Except Wire

3494 Valves and Pipe Fittings, NEC
3495 Wire Springs
3496 Miscellaneous Fabricated Wire Products
3497 Metal Foil and Leaf
3498 Fabricated Pipe and Pipe Fittings
3499 Fabricated Metal Products, NEC
3511 Steam, Gas, and Hydraulic Turbines, and Turbine Generator Set Units
3519 Internal Combustion Engines, NEC
3561 Pumps and Pumping Equipment
3562 Ball and Roller Bearings
3563 Air and Gas Compressors
3564 Industrial and Commercial Fans and Blowers and Air Purification Equipment
3565 Packaging Machinery
3566 Speed Changers, Industrial High-Speed Drives, and Gears
3567 Industrial Process Furnaces and Ovens
3568 Mechanical Power Transmission Equipment, NEC
3569 General Industrial Machinery and Equipment, NEC
3711 Motor Vehicles and Passenger Car Bodies
3713 Truck and Bus Bodies
3714 Motor Vehicle Parts and Accessories
3715 Truck Trailers
3716 Motor Homes
3743 Railroad Equipment
3841 Surgical and Medical Instruments and Apparatus
3842 Orthopedic, Prosthetic, and Surgical Appliances and Supplies
3843 Dental Equipment and Supplies
3844 X-Ray Apparatus and Tubes and Related Irradiation Apparatus
3845 Electromedical and Electrotherapeutic Apparatus
3851 Ophthalmic Goods
4311 United States Postal Service

High End Information/Business Services

2711 Newspapers: Publishing, or Publishing and Printing
2721 Periodicals: Publishing, or Publishing and Printing
2731 Books: Publishing, or Publishing and Printing
2732 Book Printing
2741 Miscellaneous Publishing
2752 Commercial Printing, Lithographic
2754 Commercial Printing, Gravure
2759 Commercial Printing, NEC
7311 Advertising Agencies
7312 Outdoor Advertising Services
7313 Radio, Television, and Publishers' Advertising Representatives
7319 Advertising, NEC
8111 Legal Services

Distribution, Freight Handling

2411 Logging
3271 Concrete Block and Brick
3272 Concrete Products, Except Block and Brick
3273 Ready-Mixed Concrete
3274 Lime
3275 Gypsum Products
4212 Local Trucking Without Storage
4213 Trucking, Except Local
4214 Local Trucking with Storage
4215 Courier Services Except by Air
4221 Farm Product Warehousing and Storage
4222 Refrigerated Warehousing and Storage
4225 General Warehousing and Storage
4226 Special Warehousing and Storage, NEC
4231 Terminal and Joint Terminal Maintenance Facilities for Motor Freight Transportation
4512 Air Transportation, Scheduled
4513 Air Courier Services
4522 Air Transportation, Nonscheduled
4581 Airports, Flying Fields, and Airport Terminal Services

Electronics, Measuring Devices

3571 Electronic Computers
3572 Computer Storage Devices
3575 Computer Terminals
3577 Computer Peripheral Equipment, NEC
3578 Calculating and Accounting Machines, Except Electronic Computers
3579 Office Machines, NEC
3612 Power, Distribution, and Specialty Transformers
3613 Switchgear and Switchboard Apparatus
3621 Motors and Generators
3624 Carbon and Graphite Products
3625 Relays and Industrial Controls
3629 Electrical Industrial Apparatus, NEC
3641 Electric Lamp Bulbs and Tubes
3643 Current-Carrying Wiring Devices
3644 Noncurrent-Carrying Wiring Devices

3645 Residential Electric Lighting Fixtures
3646 Commercial, Industrial, and Institutional Electric Lighting Fixtures
3647 Vehicular Lighting Equipment
3648 Lighting Equipment, NEC
3651 Household Audio and Video Equipment
3652 Phonograph Records and Prerecorded Audio Tapes and Disks
3661 Telephone and Telegraph Apparatus
3663 Radio and Television Broadcasting and Communications Equipment
3669 Communications Equipment, NEC
3671 Electron Tubes
3672 Printed Circuit Boards
3674 Semiconductors and Related Devices
3675 Electronic Capacitors
3676 Electronic Resistors
3677 Electronic Coils, Transformers, and Other Inductors
3678 Electronic Connectors
3679 Electronic Components, NEC
3691 Storage Batteries
3692 Primary Batteries, Dry and Wet
3694 Electrical Equipment for Internal Combustion Engines
3695 Magnetic and Optical Recording Media
3699 Electrical Machinery, Equipment, and Supplies, NEC
3821 Laboratory Apparatus and Furniture
3822 Automatic Controls for Regulating Residential and Commercial Environments and Appliances
3823 Industrial Instruments for Measurement, Display, and Control of Process Variables; and Related Products
3824 Totalizing Fluid Meters and Counting Devices
3825 Instruments for Measuring and Testing of Electricity and Electrical Signals
3826 Laboratory Analytical Instruments
3827 Optical Instruments and Lenses
3829 Measuring and Controlling Devices, NEC
3861 Photographic Equipment and Supplies

Chemicals, Pharmaceuticals

2812 Alkalies and Chlorine
2813 Industrial Gases
2816 Inorganic Pigments
2819 Industrial Inorganic Chemicals, NEC
2833 Medicinal Chemicals and Botanical Products
2834 Pharmaceutical Preparations
2835 In Vitro and In Vivo Diagnostic Substances
2836 Biological Products, Except Diagnostic Substances
2861 Gum and Wood Chemicals
2865 Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments
2869 Industrial Organic Chemicals, NEC
2873 Nitrogenous Fertilizers
2874 Phosphatic Fertilizers
2875 Fertilizers, Mixing Only
2879 Pesticides and Agricultural Chemicals, NEC
2891 Adhesives and Sealants
2892 Explosives
2893 Printing Ink
2895 Carbon Black
2899 Chemicals and Chemical Preparations, NEC

Telecomm and Banking

4812 Radiotelephone Communications
4813 Telephone Communications, Except Radiotelephone
6011 Federal Reserve Banks
6019 Central Reserve Depository Institutions, NEC
6021 National Commercial Banks
6022 State Commercial Banks
6029 Commercial Banks, NEC
6035 Savings Institutions, Federally Chartered
6036 Savings institutions, Not Federally Chartered
6061 Credit Unions, Federally Chartered
6062 Credit Unions, Not Federally Chartered
6081 Branches and Agencies of Foreign Banks
6082 Foreign Trade and International Banking Institutions
6091 Nondeposit Trust Facilities
6099 Functions Related to Deposit Banking, NEC
6111 Federal and Federally-Sponsored Credit Agencies
6141 Personal Credit Institutions
6153 Short-Term Business Credit Institutions, Except Agricultural
6159 Miscellaneous Business Credit Institutions
6162 Mortgage Bankers and Loan Correspondents
6163 Loan Brokers

Science Intensive

3761 Guided Missiles and Space Vehicles
3764 Guided Missile and Space Vehicle Propulsion Units and Propulsion Unit Parts
3769 Guided Missile Space Vehicle Parts and Auxiliary Equipment, NEC
3812 Search, Detection, Navigation, Guidance, Aeronautical, and Nautical Systems and Instruments
4822 Telegraph and Other Message Communications
4899 Communications Services, NEC
8711 Engineering Services
8712 Architectural Services
8713 Surveying Services
8731 Commercial Physical and Biological Research
8732 Commercial Economic, Sociological, and Educational Research
8733 Noncommercial Research Organizations
8734 Testing Laboratories

High Tech Machinery, Instruments

3541 Machine Tools, Metal Cutting Type
3542 Machine Tools, Metal Forming Type
3543 Industrial Patterns
3544 Special Dies and Tools, Die Sets, Jigs and Fixtures, and Industrial Molds
3545 Cutting Tools, Machine Tool Accessories, and Machinists' Precision Measuring Devices
3546 Power-Driven Handtools
3547 Rolling Mill Machinery and Equipment
3548 Electric and Gas Welding and Soldering Equipment
3549 Metalworking Machinery, NEC
3552 Textile Machinery
3553 Woodworking Machinery
3554 Paper Industries Machinery
3555 Printing Trades Machinery and Equipment
3556 Food Products Machinery
3559 Special Industry Machinery, NEC
3592 Carburetors, Pistons, Piston Rings, and Valves
3593 Fluid Power Cylinders and Actuators
3594 Fluid Power Pumps and Motors
3596 Scales and Balances, Except Laboratory
3599 Industrial and Commercial Machinery and Equipment, NEC
3931 Musical Instruments

Petroleum

2911 Petroleum Refining
3721 Aircraft
3724 Aircraft Engines and Engine Parts
3728 Aircraft Parts and Auxiliary Equipment, NEC
4612 Crude Petroleum Pipelines
4613 Refined Petroleum Pipelines
4619 Pipelines, NEC

Health Services

8011 Offices and Clinics of Doctors of Medicine
8021 Offices and Clinics of Dentists
8031 Offices and Clinics of Doctors of Osteopathy
8041 Offices and Clinics of Chiropractors
8042 Offices and Clinics of Optometrists
8043 Offices and Clinics of Podiatrists
8049 Offices and Clinics of Health Practitioners, NEC
8051 Skilled Nursing Care Facilities
8052 Intermediate Care Facilities
8059 Nursing and Personal Care Facilities, NEC
8062 General Medical and Surgical Hospitals
8063 Psychiatric Hospitals
8069 Specialty Hospitals, Except Psychiatric
8071 Medical Laboratories
8072 Dental Laboratories
8082 Home Health Care Services
8092 Kidney Dialysis Centers
8093 Specialty Outpatient Facilities, NEC
8099 Health and Allied Services, NEC

Specialized Labor Intensive

1081 Metal Mining Services
2451 Mobile Homes
2452 Prefabricated Wood Buildings and Components
2491 Wood Preserving
2493 Reconstituted Wood Products
2511 Wood Household Furniture, Except Upholstered
2512 Wood Household Furniture, Upholstered
2514 Metal Household Furniture
2515 Mattresses, Foundations, and Convertible Beds
2517 Wood Television, Radio, Phonograph and Sewing Machine Cabinets
2519 Household Furniture, NEC
2521 Wood Office Furniture
2522 Office Furniture, Except Wood
2531 Public Building and Related Furniture

2591 Drapery Hardware and Window Blinds and Shades
2599 Furniture and Fixtures, NEC
2652 Setup Paperboard Boxes
2653 Corrugated and Solid Fiber Boxes
2655 Fiber Cans, Tubes, Drums, and Similar Products
2656 Sanitary Food Containers, Except Folding
2657 Folding Paperboard Boxes, Including Sanitary
2671 Packaging Paper and Plastics Film, Coated and Laminated
2672 Coated and Laminated Paper, NEC
2673 Plastics, Foil, and Coated Paper Bags
2674 Uncoated Paper and Multiwall Bags
2675 Die-Cut Paper and Paperboard and Cardboard
2676 Sanitary Paper Products
2677 Envelopes
2678 Stationery, Tablets, and Related Products
2679 Converted Paper and Paperboard Products, NEC
2761 Manifold Business Forms
2771 Greeting Cards
2782 Blankbooks, Loose-leaf Binders and Devices
2789 Bookbinding and Related Work
3011 Tires and Inner Tubes
3398 Metal Heat Treating
3399 Primary Metal Products, NEC
3441 Fabricated Structural Metal
3442 Metal Doors, Sash, Frames, Molding, and Trim Manufacturing
3443 Fabricated Plate Work (Boiler Shops)
3444 Sheet Metal Work
3446 Architectural and Ornamental Metal Work
3448 Prefabricated Metal Buildings and Components
3449 Miscellaneous Structural Metal Work
3731 Ship Building and Repairing
3732 Boat Building and Repairing
3751 Motorcycles, Bicycles, and Parts
3873 Watches, Clocks, Clockwork Operated Devices and Parts
3942 Dolls and Stuffed Toys
3944 Games, Toys, and Children's Vehicles, Except Dolls and Bicycles
3949 Sporting and Athletic Goods, NEC
3951 Pens, Mechanical Pencils, and Parts
3952 Lead Pencils, Crayons, and Artist's Materials
3953 Marking Devices
3955 Carbon Paper and Inked Ribbons
3961 Costume Jewelry and Costume Novelties, Except Precious Metals
3965 Fasteners, Buttons, Needles, and Pins
3991 Brooms and Brushes
3993 Signs and Advertising Specialties
3995 Burial Caskets
3996 Linoleum, Asphalted-Felt-Base, and Other Hard Surface Floor Coverings, NEC
3999 Manufacturing Industries, NEC

Food and Tobacco Manufacturing

2021 Creamery Butter
2022 Natural, Processed, and Imitation Cheese
2023 Dry, Condensed, and Evaporated Dairy Products
2024 Ice Cream and Frozen Desserts
2026 Fluid Milk
2041 Flour and Other Grain Mill Products
2043 Cereal Breakfast Foods
2044 Rice Milling
2045 Prepared Flour Mixes and Doughs
2046 Wet Corn Milling
2047 Dog and Cat Food
2048 Prepared Feed and Feed Ingredients for Animals and Fowls, Except Dogs and Cats
2051 Bread and Other Bakery Products, Except Cookies and Crackers
2052 Cookies and Crackers
2053 Frozen Bakery Products, Except Bread
2061 Cane Sugar, Except Refining
2062 Cane Sugar Refining
2063 Beet Sugar
2064 Candy and Other Confectionery Products
2066 Chocolate and Cocoa Products
2067 Chewing Gum
2068 Salted and Roasted Nuts and Seeds
2074 Cottonseed Oil Mills
2075 Soybean Oil Mills
2076 Vegetable Oil Mills, Except Corn, Cottonseed, and Soybeans
2077 Animal and Marine Fats and Oils
2079 Shortening, Table Oils, Margarine, and Other Edible Fats and Oils, NEC
2082 Malt Beverages
2083 Malt
2084 Wines, Brandy, and Brandy Spirits
2085 Distilled and Blended Liquors
2086 Bottled and Canned Soft Drinks and Carbonated Waters
2087 Flavoring Extracts and Flavoring Syrups NEC
2111 Cigarettes

2121 Cigars
2131 Chewing and Smoking Tobacco and Snuff
2141 Tobacco Stemming and Redrying
2992 Lubricating Oils and Greases
2999 Products of Petroleum and Coal, NEC

Securities

6211 Security Brokers, Dealers, and Flotation Companies
6221 Commodity Contracts Brokers and Dealers
6231 Security and Commodity Exchanges
6282 Investment Advice
6289 Services Allied With the Exchange of Securities or Commodities, NEC

Building Products

2431 Millwork
2434 Wood Kitchen Cabinets
2435 Hardwood Veneer and Plywood
2436 Softwood Veneer and Plywood
2439 Structural Wood Members, NEC
3299 Nonmetallic Mineral Products, NEC
2541 Wood Office and Store Fixtures, Partitions, Shelving, and Lockers
2542 Office and Store Fixtures, Partitions, Shelving, and Lockers, Except Wood
3241 Cement, Hydraulic
3251 Brick and Structural Clay Tile
3253 Ceramic Wall and Floor Tile
3255 Clay Refractories
3259 Structural Clay Products, NEC
3261 Vitreous China Plumbing Fixtures and China and Earthenware Fittings and Bathroom Accessories
3262 Vitreous China Table and Kitchen Articles
3263 Fine Earthenware (Whiteware) Table and Kitchen Articles
3264 Porcelain Electrical Supplies
3269 Pottery Products, NEC
3281 Cut Stone and Stone Products
3295 Minerals and Earths, Ground or Otherwise Treated
3296 Mineral Wool

Source: Edward .J. Feser, Associate Professor, Department of City and Regional Planning, University of North Carolina – Chapel Hill (2003).

The Institute for Decision Making is the community and economic development outreach unit of the University of Northern Iowa's College of Business Administration. Since 1987, IDM has been a source of assistance for over 460 economic development organizations in Iowa. IDM has continually updated and revised its services of visioning and strategic planning, short-term economic development planning, community marketing and applied research to better meet the changing needs of Iowa communities. IDM's innovative applied research has included a survey and analysis of speculative buildings, measuring the economic impact of festivals, targeted industry analyses, cluster analyses, community assessments, and laborshed analyses. IDM assumes an active economic development leadership role in Iowa and beyond and continues to earnestly recognize the needs and opportunities of Iowa's communities as its priority.

Institute for Decision Making
Business and Community Services
University of Northern Iowa
Curris Business Building, Suite 5
Cedar Falls, IA 50614-0120
319-273-6941; 319-273-6830 (fax)
www.bcs.uni.edu/idm