

**ECONOMIC DRIVERS
EXECUTIVE SUMMARY
CITY OF BOULDER, BOULDER COUNTY, COLORADO**



May 2008

EXECUTIVE SUMMARY

The Boulder Economic Council engaged the services of the Business Research Division (BRD) at the Leeds School of Business to conduct a project to identify the industries and clusters that drive the City of Boulder and the Boulder County economy.

The BRD research team set up the following guidelines for evaluating industries and clusters as potential drivers of the local economy:

- Any industry or cluster must be definable using NAICS codes;
- The industries or clusters must be measurable for the purpose of evaluating trends, performing analyses moving forward, and for comparisons between geographical areas;
- Criteria for evaluating the importance of industries and clusters on economies, the research team identified the following metrics as indicators of economic drivers:
 - Boulder brand
 - Diversity in local economy
 - Employment
 - Firms
 - GDP
 - Location quotient
 - Multiplier
 - Providing services
 - Role in regional economy
 - Wage and employment growth
 - Wages

In the process of identifying sectors that drive the economy, the BRD research team fully understood that all sectors play an integral role in the local economy.

Based on this process, the BRD research team determined whether companies were primary or secondary industries or clusters. Primary industries are those that bring in money from the outside and cause other industries to form or expand. Secondary industries grow and decline as a result of growth in primary industries. They typically support the basic needs of the workforce and population.

Each of the 19 North American Industry Classification System (NAICS) sectors was analyzed to determine whether they are primary or secondary industries. The secondary industries were then evaluated in terms of their relationship to the prominent clusters in the local economy (advanced technology, aerospace, biosciences, energy, homeland security, information technology, food, nanotechnology, photonics, sports/sporting goods, radio-frequency identification [RFIDs], and tourism).

The most significant primary industries support the clusters of advanced technology (AT) and tourism. Four NAICS industries help drive AT and various technology-based clusters:

- Professional, scientific and technical services
- Manufacturing
- Information
- State and federal government

Two NAICS industries comprise the tourism cluster:

- Accommodations and food services
- Arts entertainment and recreation

The following section briefly highlights the strengths of each of these six sectors in Boulder based on wages and the number of firms and employees in each group.

Professional, Scientific, and Technical Services (PST)

A total of 2,830 firms in the PST sector employ 21,400 workers in Boulder County. Average annual wages are \$85,904. About 23% of county firms and approximately 14% of county workers are in the PST sector. It accounts for roughly 23% of total county wages (Figure 1).

The following PST subsectors are strengths in the local economy, and are critical to AT and other high-tech clusters:

- Architecture
- Computer facilities management
- Computer programming (custom)
- Computer systems design
- Consulting
- Direct mail
- Engineering
- Environmental consulting
- Mapping
- Market research
- Marketing consulting
- Scientific research
- Translation and interpretation

Manufacturing

Boulder is not typically thought of as a strong manufacturing community. Over the years, the creative spirit of the county has made it a focal point for clean manufacturing firms. These firms are a critical component of the AT, food, and sports/sporting goods clusters.

Approximately 590 manufacturers in Boulder County employ about 18,650 workers. Average annual wages are \$72,904. Although only about 5% of the county's firms are manufacturers, roughly 12% of the employees work for manufacturers and around 17% of total county wages are paid to manufacturing workers (Figure 2).

Figure 1: PST in Boulder County, 2006



Boulder’s manufacturing strengths are based in technology spawned out of research conducted at local labs, universities, and companies. Much of this research is in enabling technologies, such as photonics, software, and nanotechnology. These technologies provide support for the aerospace, biosciences, information technology, and energy industries. The areas of strength are:

- Analytical and medical devices
- Circuit boards
- Semiconductors
- Computer storage
- Food processing
- Instruments and devices
- Machines shops
- Optics and communications equipment
- Pharmaceuticals
- Software reproducing

Information

Information firms total 390 in Boulder County and employ 8,860 workers. Average annual wages are \$83,616.

The information sector accounts for less than 5% of the total county firms, and about 5% of the workers are employed in this area. The sector represents almost 10% of the county’s total wages (See Figure 3).

The primary strength of the information sector in Boulder County is software. IBM, which is classified in the software sector, is Boulder County’s dominant software employer. Additional areas of strength include data processing, directory and mailing lists, greeting cards, ISPs, newspapers, and periodicals.

Figure 2: Manufacturing in Boulder County, 2006

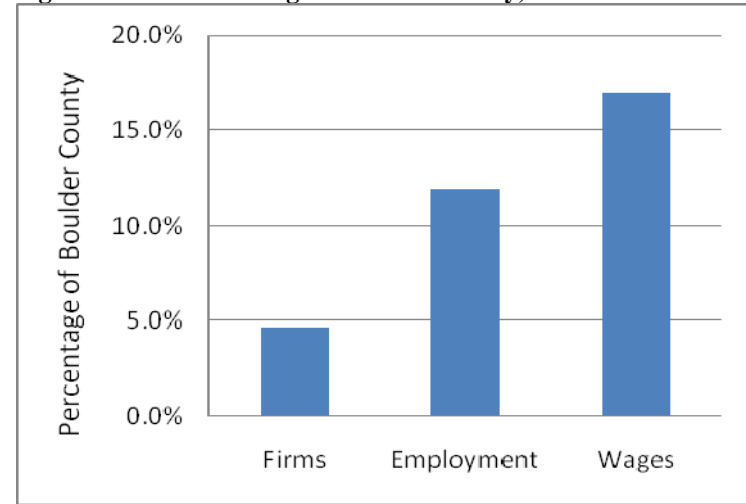
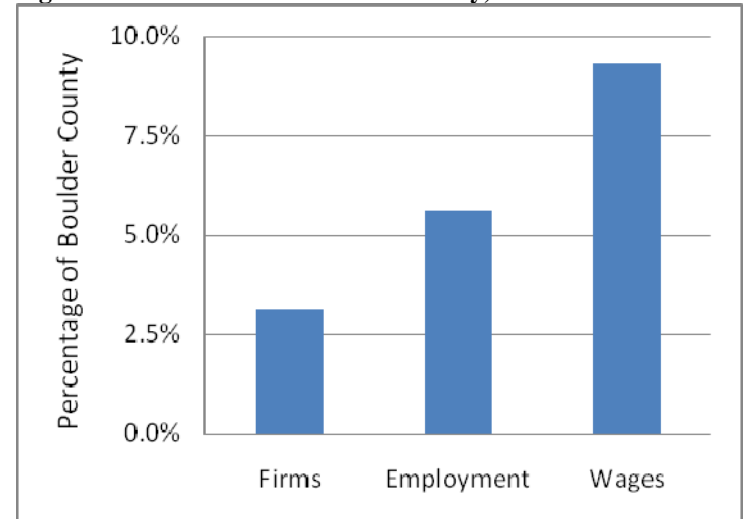


Figure 3: Information in Boulder County, 2006



Government

In many economies, the government sector would not be considered a primary industry. However, in the case of Boulder County, federal government and state education have been identified as primary industries and local government as a secondary industry. The federal government sector includes the federal labs, while state education is comprised primarily of the employees at the University of Colorado and a branch of Front Range Community College.

State educational and federal organizations in Boulder County total 37, and employ 12,546 workers at average annual wages of \$55,044. These organizations account for about 7% of the county workforce and 8% of total wages (

Figure 4). The state and federal sectors of the economy provide high wages, support for all clusters in the local economy, and add to the intellectual firepower of the community.

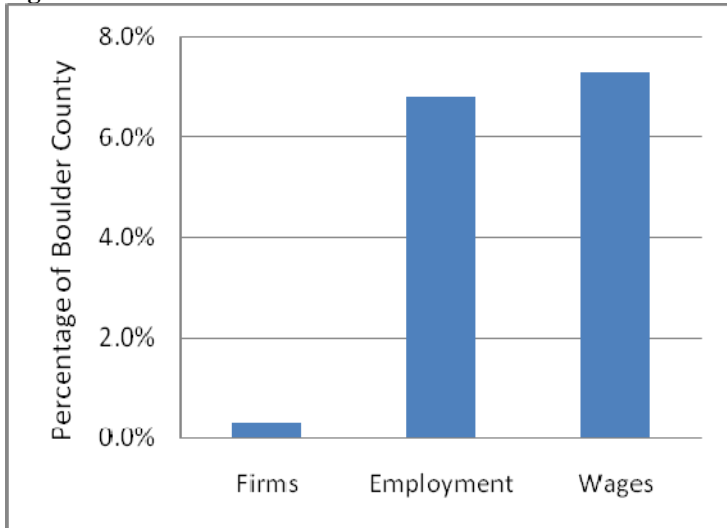
Boulder's presence as a national player in federal research began when the National Bureau of Standards (NBS) began looking for a home outside of Washington, D.C. The Boulder Chamber of Commerce recognized the potential value of the facility and ran a successful subscription campaign to raise money to purchase the NBS site, which transferred 206 acres to the U.S. government in 1950. This became the future of NIST, NOAA, and NTIA. Excess funds from the subscription campaign paid for land in east Boulder to foster the commercialization of rocket research being conducted at the University of Colorado, which was the beginning of Ball Aerospace.

Advanced Technology (AT)

AT accounts for 2,257 firms in Boulder County that employ 35,477 workers who earn total wages of \$3.3 billion. Average annual wages for AT employees in Boulder County are \$93,138. The cluster accounts for about 19% of Boulder County firms, but only 10% of state firms (

Figure 5). AT workers represent 22.6% of total county employment, compared to 8.5% of total state employment. Finally, AT wages in Boulder County make up more than 41% of total county wages and about 17% of total state wages. The AT sector provides many high-paying jobs, supports other industries, and is a major part of the local creative economy.

Figure 4: Federal Government and State Education in Boulder County, 2006



The PST, manufacturing, information, and government sectors provide the foundation for the economies of the City of Boulder, Boulder County, and Colorado. As defined by the Colorado Department of Labor, AT has played a significant part of the state economy since 1990. At that time, the state had a location quotient of 1.3 for AT firms, meaning that Colorado’s concentration of AT employment was 30% greater than the national concentration of AT employment. As AT boomed locally and nationally, Colorado’s location quotient exceeded 1.5 until 2001, followed by a steady decline back to the 1990 level. (See

Figure 5: Advanced Technology in Boulder County, 2006

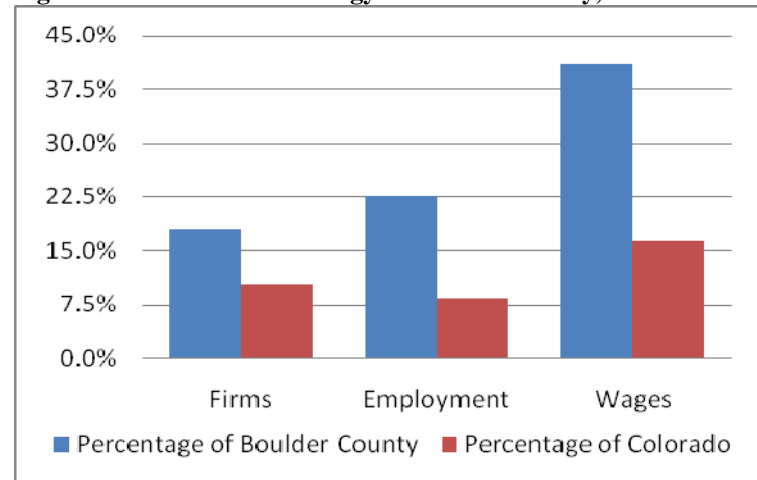
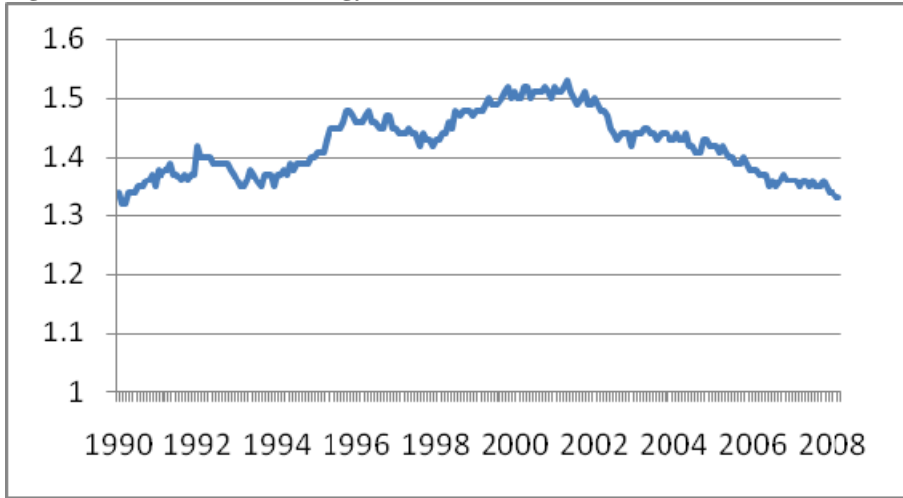


Figure 6.)

Indexing Colorado’s AT employment to total Colorado employment and U.S. AT employment to total national employment shows the greater magnitude of the cluster’s rise in Colorado compared to the national cluster. In percentage terms, the boom and bust cycle affected Colorado’s total employment more than the national correction. (See Figure 7.)

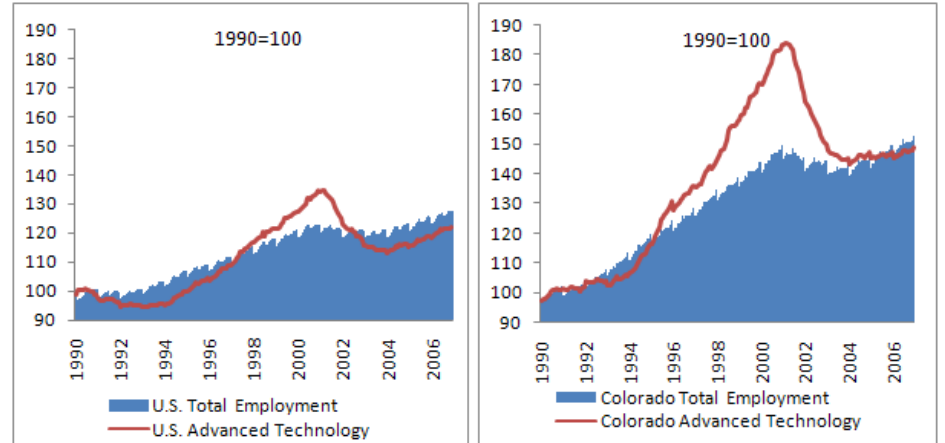
Despite the recent economic downturn, AT has grown at a pace similar to that of the overall economy since 1990. With the greatest concentration of AT workers in the state, Boulder County is the focal point for Colorado’s AT cluster. In addition, Boulder has the most diversified AT economy, with a high number of workers in companies that produce products in enabling technologies (photonics, nanotechnology, and software) and in the aerospace, biosciences, and information technology areas.

Figure 6: Advanced Technology in Colorado, Location Quotient, 1990-2008



Source: Colorado Department of Labor and Employment.

Figure 7: Advanced Technology in Colorado, Employment Index, 1990-2006



Source: Colorado Department of Labor and Employment.

Tourism

The tourism cluster is comprised of the arts, entertainment, and recreation sector and the accommodations and food services sector. Combined, these clusters employ about 10% of total county workers, but pay only 3% of total wages (Figure 8). Average wages are skewed by the number of part-time workers in the cluster.

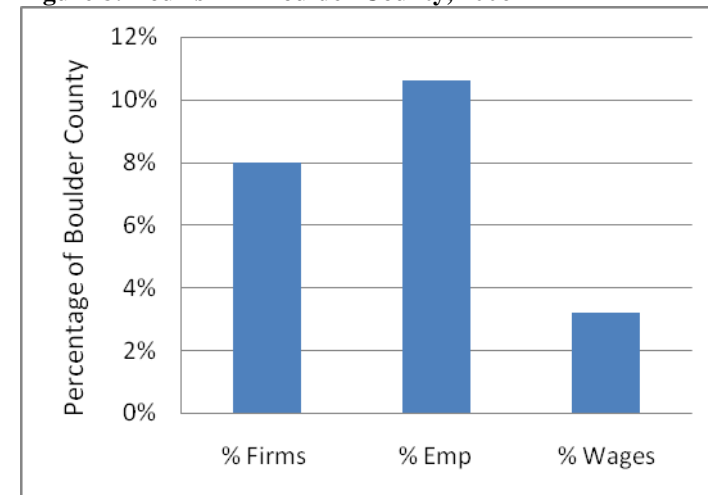
The cluster is important to the local economy for several reasons.

- It draws people to the area.
- It supports the active lifestyle of the community.
- It employs a significant number of workers.
- The part-time nature of employment in the cluster provides college students with work opportunities.

Attractions such as Eldora Ski Area and the local dinner theatres draw people to the area. Visitors to the area and those passing through on their way to Rocky Mountain National Park or other destinations can benefit from other tourism-related strengths, including:

- Full-service restaurants (NAICS 722110)
- Bed and breakfast inns (NAICS 721191)
- Boarding houses (NAICS 721310)
- Nonalcoholic beverage bars (NAICS 722213)
- RV parks and recreational camps (NAICS 721211)
- Agents for public figures (NAICS 711410)
- Independent artists, writers, and performers (NAICS 711510)
- Promoters without facilities (NAICS 711320)

Figure 8: Tourism in Boulder County, 2006



Evolution of AT in Boulder County

Because the AT sector is the most significant driver of the Boulder County economy, it is important to review how it has evolved over the past 50 years. The following overview of AT is not intended to be a comprehensive history of cluster in the Boulder Valley. Rather, it is our intent to illustrate why Boulder County has the state's most diversified AT economy and that it has developed as a result of activity in both the public and private sector.

The early roots of AT in Boulder County can be traced to the end of World War II. NIST, then known as the National Bureau of Standards (NBS), was located in Washington, D.C. The Central Radio Propagation Laboratory (CRPL) conducted research in radio and radar in support of WWII. CRPL sought to relocate to get away from the crowded airwaves in the Washington area and to support the Truman Administration plan to move major federal facilities outside of Washington in the event of an atomic bomb attack.

The Boulder Chamber of Commerce (BCC) started a subscription campaign to raise money to purchase the land for the NBS site, and in fact, raised more money than it needed. On June 14, 1950, the deed for 206 acres south of the intersection of Broadway and Baseline Road was transferred from the chamber to the U.S. government. President Eisenhower dedicated the radio research laboratories in 1954.

The BCC used the remaining funds from their subscription drive to purchase land on Arapahoe Street. It was on this site that Ball Brothers Research started commercialization of the rocket research that had been conducted at CU by Merc Mercure and others. This was the starting point of the aerospace industry in Boulder County.

In 1962, the NBS founded a cooperative institute on the University of Colorado campus called the Joint Institute for Laboratory Astrophysics (JILA). It was among the first scientific ventures in the country between a federal agency and a major research university. JILA has since been home to three Nobel Prize winners: Carl E. Weiman, Eric A. Cornell, and Jan Hall.

In 1965, IBM opened a manufacturing facility at the intersection of Colorado Highways 52 and 119. The facility was classified as a manufacturer of office

and computer equipment. During the mid-80s the mission of the facility changed from manufacturing to software and support services. An economic impact analysis of the facility shows that it generates more than \$1 billion in economic activity for Colorado every year. In addition, another research study conducted by the Leeds School of Business revealed that at least 80 additional Boulder County companies are part of the IBM Boulder family tree. This is one of many examples illustrating the impact of the creative spirit within the Boulder Valley. Both directly and indirectly, IBM has played a critical role in both the development of the storage and software clusters.

During the 1970s, the biosciences were not part of the economic development strategy for Colorado or most other states. As a result, the research conducted by CU biochemistry professor Marv Caruthers at this time was not viewed as significant from an economic development perspective. Caruthers and a team of peers quietly formed Amgen in Southern California. Today Amgen is the world's largest biosciences firm with a strong presence in the City of Boulder and Boulder County. Caruthers' research produced a group of innovators whose findings provided the foundation for such local companies as Genentech, Array BioPharma, Biostar, and Dharmacon.

Tom Cech's discovery of ribozymes in the 1980s was another biosciences success for CU and Boulder County. From that research Cech received a Nobel Prize in 1989. He formed a company, RPI, which later became Sirna Therapeutics.

Around the same time, Larry Gold and his associates from CU's Molecular, Cellular, and Developmental Biology Department conducted research that resulted in the formation of Synergen. Synergen nearly achieved commercial successes and was acquired by Amgen in 1994. Out of this effort came NeXagen, NeXstar, Proligo, Archemix, OSI Pharmaceuticals, and SomaLogic.

In 1987, CU and CSU Engineering received a NSF grant to develop a prestigious Engineering Research Center, the Optoelectronic Computing Advanced Photonics Technology (CAPT) Center were formed as support for Colorado companies. A genealogical study performed by the Leeds School shows that about 20 Boulder County companies have spawned out of OCSC. The significance of the OCSC is that it fostered the growth of photonics, an enabling technology that is essential for clusters such as aerospace, biosciences, homeland security, and renewable energy.

As part of the technology boom of the 1990s, Sun Microsystems opened its doors in 1998, followed by Level 3 in late 1999. Sun later acquired neighbor StorageTek as a means of bolstering Sun's storage management capabilities.

With the election of Governor Bill Ritter came the Colorado Promise and the designation of biosciences, aerospace, renewable energy, and tourism as

Systems Center (OCSC). In addition to the research supported by the center, the Colorado Photonics Industry Association (CPIA) and the Colorado the state's targeted industries. Boulder County is well-positioned to take a leadership role in the development of the state's economy in each of these areas. In 2008, the Boulder Valley took a step forward in the execution of the state's economic development plan with the implementation of CU's Energy Initiative and the announcement that ConocoPhillips had purchased the old StorageTek facility with the intent of developing a training center that would be a hub for research and development of renewable energy and carbon fuels recovery. The site is expected to be redeveloped over the next five to seven years. On a similar note, RES Americas announced that it would move its headquarters to Broomfield, and Siemens Energy announced that they planned to establish a wind research and development center in Boulder. Finally, the City of Boulder was selected by Xcel Energy to become the US' first fully integrated Smart Grid City.

Key Findings/Concluding Comments

In the process of identifying the primary and secondary drivers of the economy, it should be remembered that all industries and clusters are important to the economy in different ways. It is beneficial to have a diverse economy that includes a balance of primary and secondary industries. Economic drivers in Boulder include industries that are the foundation of the AT and tourism clusters in the city and county. In particular, the concentration of Boulder primary industries that support AT help drive the city, county, region, and state economies.

The success of the AT cluster will be impacted by the ability to:

- Leverage Boulder's strengths in cooperative efforts with other cities, counties, states, and regions;
- Secure state and federal funding to protect Colorado's assets (labs and higher education); and
- Continue support for a strong business community.

The success of the local tourism cluster will be impacted by:

- Taking advantage of special events, such as the Bolder Boulder;
- Building on University of Colorado events and programs, such as graduation and athletic events;
- Developing facilities to attract and house visitors to Boulder; and
- Supporting state and local tourism efforts.