

CRAFTING CLUSTERS: AN ANALYSIS OF THE CRAFT BEER INDUSTRY IN
NORTHERN COLORADO

by

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Abstract

The following report examines the craft beer industry as a major component of the beverage production cluster in Northern Colorado. By using the four locational determinants derived by Porter (1990) as a framework, this study evaluates the role of geography as a key component in an industry's ability to foster a competitive advantage. Despite his focus on national competitiveness, Porter's diamond model has influenced strategic thinking on a regional scale (Stimson, Stough & Roberts, 2006). In turn, it can help us to understand the interactions that underlie localized cluster dynamics. The cluster conception in economic development literature assumes that each of Porter's components is equally spatially connected. Resources are focused towards building assets in a region defined by analyzing the cluster. However, factors of the craft beer industry in Northern Colorado did not completely adhere to the traditional parameters of regional cluster geography. Personal interviews with key actors involved in the craft beer industry, along with economic data revealed that local factors are not always the driving force behind the development of the craft beer industry. In addition, the data analysis indicates that determinants of cluster success may be significant at various geographic scales. Locational determinants may not operate within the same area as defined by cluster analysis. Thus, this report closes with a recommendation to consider the significance of proximity when looking to increase the competitiveness of a given industry cluster—for the relationship between locational determinants and geography varies between factors.

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Dedication

This report is dedicated to Colin Victory—a good friend and a fellow member of the vice squad. Thank you for being my note-taker and for spotting me at the gym. It is one of my greatest hopes that all of our hard work in this program pays off, and that someday, you and I will work our way up to planning technician for a small, rural town in North Dakota.

Chapter 1 - Introduction

The aim of this study is to explore the craft beer industry in Northern Colorado as a paradigm of an ideal cluster in order to better understand the role of place in cluster formation. With seventeen microbreweries, Fort Collins and the surrounding Northern Colorado region has fostered a high concentration of the industry at the root of Colorado's "beer culture" and is a hub that caters to the demands of beer enthusiasts. A cluster analysis based on a combination of one-on-one interviews with key actors involved in the craft beer cluster and secondary data provided by various public sources was collected to understand how this particular cluster operates. The four locational determinants isolated by Porter (1990) serve as a framework for this analysis.

Fort Collins has the most microbreweries per capita in the state of Colorado. There are fifteen microbreweries in the city alone. The microbrewing industry in the city provides jobs for over 500 residents. The City of Fort Collins has declared that the craft brewery industry is a major component of its Creative Industries Cluster that includes arts, culture, and tourism. It is named *The Uniquely Fort Collins Industry Cluster*. According to the city, it is a growing industry that is helping to shape the local economy (Fort Collins, 2015). The social fabric and business environment in the region have cultivated an atmosphere that promotes technological innovation and economic vitality within the craft beer industry.

The aim of this research is twofold. First, I determine whether proximity is a vital component in each of the four points of Porter's Diamond. Second, I analyze the geographic scale that is most significant for understanding each point of the diamond. Industry clusters are a major focus of economic development and regional planning policy. Understanding geographic properties of a specific cluster may lead to a better overall comprehension of cluster function. If Porter's Diamond Model is capable of explaining the geographic advantage of the regional craft beer industry in Northern Colorado, its implications can be applied to similar industry clusters in other regions.

Guiding this case study of the craft beer industry in Northern Colorado will be one of the most prominent frameworks within the study of industry clusters: Porter's Diamond Model. This model provides a framework that aids in identifying and analyzing the interactions between the factors that underlie local competitiveness. According to Porter (1990), firms engaged in global market production will locate based on four determinants: factor conditions, related and supporting industries, demand conditions, and firm strategy. The model also includes two exogenous effects that indirectly affect a firm's competitive advantage: government and chance.

Cities often invest in cluster development as a means of economic development. Business retention, expansion, and attraction efforts may be geared toward a specific industry because cities believe that a successful industry cluster will yield a high local economic impact. When firms in a related industry position themselves in close proximity to one another and establish a connection, an economic phenomenon takes place. Spatial relations between firms within a given industry yield numerous benefits to many of the players involved. Often times this is achieved through an increase in productivity triggered by the influence of related industries, firms, and institutions (Porter, 1990).

An illustration of this geographic paradigm is the beverage production industry in the Front Range of the Rocky Mountains. It has been established that, as a whole, the beer industry is a key economic driver for the entire region (Metro Denver EDC, 2016; Marturana & Shields, 2011; Development Research Partners, n.d). It has created a strong pull factor in which businesses and tourists gravitate towards. Throughout the entire region there are a growing number of brewing companies (this includes microbreweries, brewpubs, contract brewing companies, and regional craft breweries) that thrive off the collaborative environment and supporting community.

A major segment of beverage production is the craft beer industry. It is a market that has taken off all around America and especially throughout the Front Range of Colorado. All definitions of the brewing cluster in Colorado stress the vital role the craft beer segment plays. In recent years the beverage industry has been reshaped by a shift in consumer preference. Specialty beverages are beginning to take hold in the beverage market, a trend that is manifest by an increase in sales of craft beers and a decrease in mass-produced beer (Metro Denver EDC, 2016). This rising tide in American culture is paving the way for the continued growth of the beverage production cluster, spurring economic growth, attracting new businesses, and pulling in new consumers. As such, this segment plays a leading role in the overall growth and success of the brewery industry cluster.

Due to its highly interconnected beer industry, Fort Collins and its surrounding environs is a prime location to examine the competitive dynamics involved in an industry cluster. By exploring this topic, I can better understand how theories of agglomeration transfer over to regional clusters. These theories ultimately guide the professional practice of urban planning and economic development, thus their implications within real life applications are fundamental to setting best practice standards.

Chapter 2 - Craft Beer in Fort Collins

Craft beer plays a major role in the Fort Collins area – both in the regional economy and the social environment. In the area referred to as Northern Colorado, which includes the Fort Collins and Greeley metropolitan areas, there are a total of seventeen microbreweries. Supporting these breweries is a wide range of related industries, a diversified population, and an abundance of unique land and regional qualities that support craft beer production and demand. The Coloradoan has referred to this area as the, “Napa Valley”, of beer (Sexton, 2015). Fort Collins currently defines one of the highest upper limits of barrels set upon microbreweries in the nation (Best, 2015).

In February 2015, an article titled “Welcome to Beer Country” published in *Planning* covered the history of brewing in Fort Collins. Thanks to a brewery-induced revitalization effort that began in the early 1980s, the downtown area of Fort Collins was renewed both economically and socially. During the eighties Fort Collins was viewed as a prime location for small breweries, known as a place of grain elevators, low-cost rent, and sparse residential developments. Anheuser-Busch was the first beer company to move to the area; as such it served as an anchor on Interstate-25. Several small breweries quickly ensued. Amongst the first of the microbreweries were Odell Brewing Company and New Belgium. At the time there was no specific zoning classification under which these companies would fall. This was due to a lack of knowledge surrounding the industry; subsequently, local planners allowed them to be situated in light-industrial areas of the city.

Over the next several decades, the emergence of microbreweries helped to change the old industrial section of the college town. As Fort Collins continued to grow, so did the demand for craft beer. The area’s breweries and restaurants ultimately paved the way for urban renewal efforts. As brewpubs gained popularity, they were able to upgrade and become more refined. Many were able to expand their operations and compete on a national level. As more and more people were drawn to the region to experience this unique industry, it opened up the opportunity for additional microbreweries. Inevitably, market saturation became an eminent threat, but this merely pushed breweries to become more creative, permitting only the most innovative breweries to continue operations. Craft beer helped to shape a local culture that allowed the brewing industry to thrive.

One measure used to examine the significance of a particular industry is known a Location Quotient (LQ). This indicator compares an industry’s share of local employment relative to that industry’s share of national employment. A LQ greater than 1 indicates that an industry is more locally concentrated when compared to the nation. These sectors are referred to as basic industries

and are assumed to be exporting their products outside the region. They serve as an important link to the broader, outside economy. A LQ less than 1 signifies that a given sector is not meeting local needs. Thus, the region does specialize in that industry and is considered a non-basic industry (Hustedde, Shaffer & Pulver, 1993).

I calculated location quotients for Fort Collins using data from the U.S. Census Bureau, 2013 County Business Patterns. This was done to assess the city for craft beer employment concentration, to get a sense of the magnitude of the craft beer industry in the region, and to verify if the region truly specializes in the craft beer sector. Industry employment data is organized under NAICS (North American Industry Classification System). The four digit NAICS code for brewing is 1312. I defined craft brewing establishments as those with fewer than 500 employees. Because specific employment data was not available for the number of employees at macro-brewery Anheuser Busch, an approximation was made. A median approximation of 750 employees was used based on the given range of 500 to 999 employees.

According to information provided by the County Business Patterns, the location quotient for all breweries in Fort Collins (both microbreweries and macrobreweries) is 43.56. This value signifies that Fort Collins has an astronomical concentration of employees in the brewing industry when compared to the national employment of brewery workers. While craft beer is highly concentrated in the region when compared to the nation, a portion of it may be attributed to the macrobrewery Anheuser Busch, a large brewery that employs somewhere between 500-999 employees. The location quotient for the craft beer industry, specifically, is 33.13. Though this value is less than location quotient for all breweries, it is still exceptionally high, showing that craft beer is much more concentrated in the city of Fort Collins than the majority of cities across the nation.

$$\text{LQ for microbreweries} = \underline{33.13}$$

$$\frac{\text{Fort Collins Craft Beer Employment/Fort Collins Total Employment}}{\text{U.S.Craft Beer Employment/U.S.Total Employment}}$$

$$\text{LQ for all breweries} = \underline{43.56}$$

$$\frac{\text{Fort Collins Brewing Employment/Fort Collins Total Employment}}{\text{U.S.Brewing Employment/U.S.Total Employment}}$$

Definition of Craft Beer

Over the past few decades the brewery industry has helped to shape regional economies across the nation. It is no longer just a handful of large beer manufactures that are supporting the industry. Small, traditional brewers have begun to lead the way. Beer enthusiasts are no longer limited to a small number of beer styles. Consumers expanding preferences are being met with a large variety of specialized goods. A growing portion of consumers is steering towards these smaller breweries due to their unique, more traditional offerings. As opposed to high-volume beer production, small independent companies have entered the market to meet new areas of demand and have become substitutes for mass produced beer. Overall, the craft beer segment has had a transformative effect on the overall beer industry.

Within the U.S. Market, beer can fall under three potential categories: mass-produced beer, craft beer, and imports (Toro-Gonzalez, McCluskey & Mittelhammer, 2014). Three defining traits differentiate craft breweries from other beer producers. According to the American Beer Association, craft breweries are small, independent, and traditional (Brewers Association, 2015). Driving these companies is innovation. They rely upon historic styles and traditional ingredients combined with unique twists to develop new styles that are individualistic in nature. Products are often very distinct from their non-micro rivals and target niches of the beer market. Additionally, craft brewers tend to be involved in their communities. Often times these companies will reach out to their community through philanthropy, donations, volunteerism and sponsorship of community-wide events (Brewers Association, 2015).

There are four major ingredients when brewing beer: water, barley, hops, and yeast (Broas, 2016). Brewing relies on a quality water supply. Water that is not brewing quality must be treated until it is. A brewer's ability to adjust water profile can have a profound effect on the final product. Water constitutes 90 percent of the finished product. Next, barley is used for producing the sugars needed to turn yeast turns into alcohol. Barley is first processed into malt before it is used in beer. A professional maltster will typically do this by soaking the barley in water and allow it to germinate and produce the by-products used in fermentation. Hops are added to balances out the sweetness contributed by the malt by adding bitterness. Finally, yeast is used in the brewing process to convert the sugar in beer into carbon dioxide and alcohol (Broas, 2016).

Definition of Craft Beer Cluster in Fort Collins

Several studies have assessed the brewing industry throughout Colorado. In 2014, the Brewers Association provided an in-depth look into the economics of the craft beer industry by state. Colorado ranks 3rd in terms of the number of craft breweries, and 5th in terms of economic impact. Further justifying the state as a leader in the craft brew industry, in 2014, Colorado was ranked 1st in impact per capita and 3rd in terms of craft beer production measured by the number of barrels produced in a given year. The number of craft breweries in the state has nearly doubled between 2011 and 2014 (Brewers Association, 2014).

The craft beer segment is an important part of the brewing industry, which serves as an economic engine for the region. With this, various organizations have defined the craft beer industry in Northern Colorado. The sector falls under several different cluster classifications. It has been grouped into the beverage production cluster defined by the Denver Metro Economic Development Corporation (2015). It has been identified as part of the brewing cluster in Larimer County (Marturana & Shields, 2011). It has been grouped into the arts, culture, and tourism or *Uniquely Fort Collins Cluster* defined by the City of Fort Collins (Development Research Partners, n.d.). And, it has been classified as the malt beverage cluster in Fort Collins (Orsini-Meinhard, 2005).

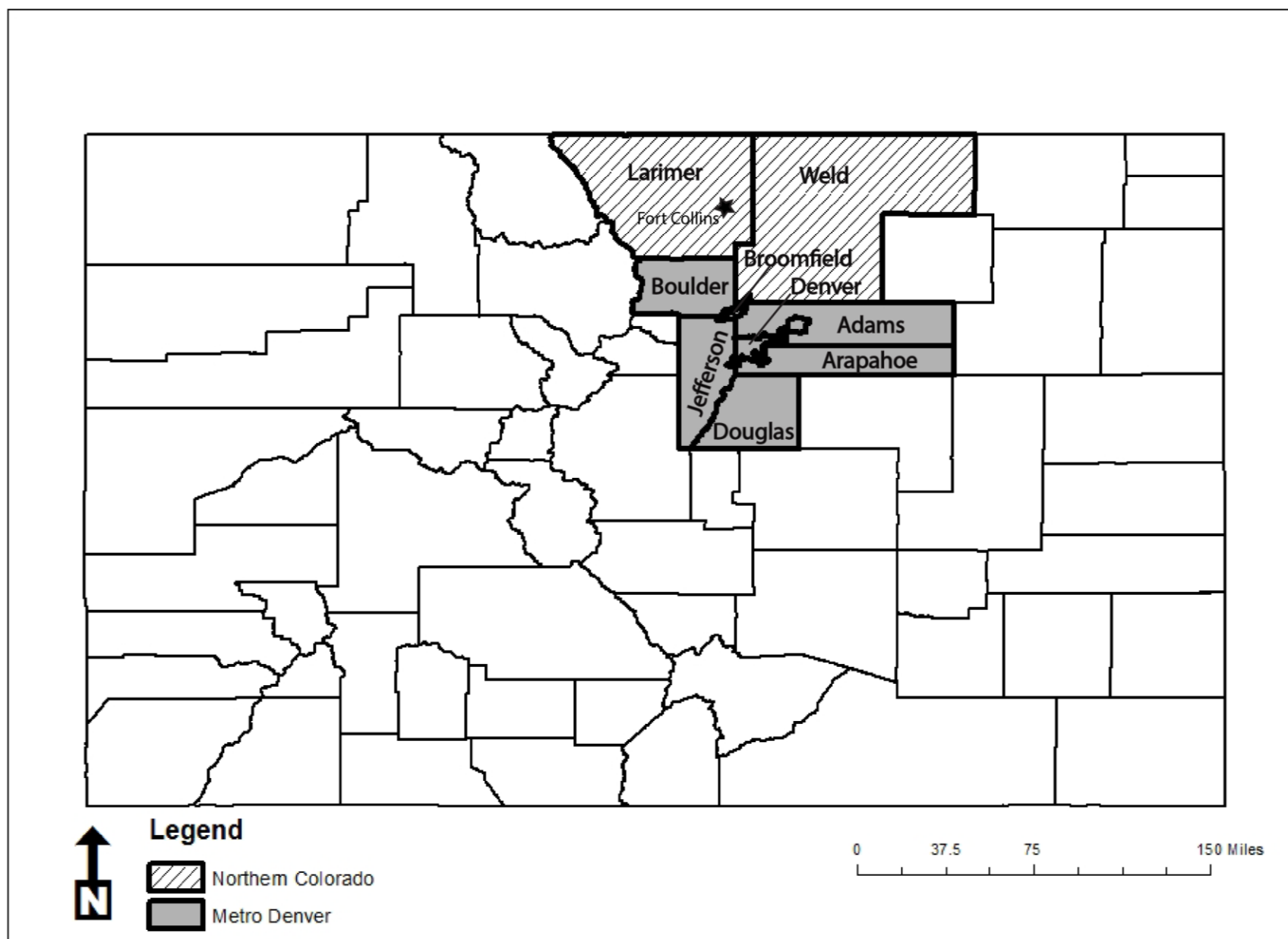
Similarly, the beer cluster in the northern portion of the Colorado Front Range has been classified on multiple geographic scales. As part of the beverage production cluster, it has been linked to the Metro Denver area and Northern Colorado, delineated by a nine county region that includes: Larimer, Weld, Boulder, Jefferson, Broomfield, Denver, Adams, Arapahoe, and Douglas. (Metro Denver EDC, 2016). It has also been classified as the brewery cluster in Northern Colorado, which consists of only Larimer County (Marturana & Shields, 2011). Other studies have it situated in only the city of Fort Collins (Orsini-Meinhard, 2005).

According to the Denver Metro Economic Development Corporation, the beverage production industry cluster in Colorado extends along the Front Range of the Rocky Mountains from Denver upward to the border of Wyoming. It is a nine county region shown on figure 2.1 that is delineated by the Metro Denver Area and Northern Colorado Region (Metro Denver EDC, 2015). Included in this industry's classification are malt beverages, wines, distilled liquors, bottled drinks, and ice products. With this, the Denver Metropolitan area has thirty-five and the Boulder area has thirteen. The benefits produced by this particular cluster ripple outward to several other

business activities in several other sectors. This includes agriculture, energy, and bioscience, as these sectors share related production mechanisms as well as many similar raw materials.

Researchers from the Regional Economics Institute at Colorado State University assessed the economic impact of the brewing industry on Larimer County, Colorado. The analysis determined that in 2010, local breweries supported 938 direct jobs, which is a growth of over 21 percent in the ten years span between 2000 and 2010. Additionally, the study found that the breweries in Larimer County supported a total of \$309.9 million in output and 2,488 jobs, all while adding \$141.9 million directly to local payrolls. The positive direct and indirect impacts that stem from the brewing industry indicate that the industry plays a key role in the region's competitive economic base (Development Research Partners, n.d; Marturana & Shields, 2011; Metro Denver EDC, 2016; Orsini-Meinhard, 2005). Overall this impact assessment shows the vital roll that the brewing industry plays on the regional economy, and how the craft beer culture ultimately permeates through the community's lifestyle.

Figure 2.1. Map of Cluster Area



Source: U.S. Census Bureau. 2010 Tiger/Line Shapefiles: Counties.

Chapter 3 - Literature Review

The following literature review provides an overview of the cluster concept through information on both a macro and micro level—covering terminology, frameworks, methodologies, and strategies relevant to this study. I begin by defining the term *industry cluster* and what differentiates this term from *agglomeration*. Subsequently, I cover Porter’s Diamond Model and the four locational determinants that provide its framework. Next, I briefly review some of available analyses used to examine industry clusters. I conclude with a discussion of economic development theory in light of industry cluster development. Ultimately, past literature may help shed light on the complexity that surrounds the study of industry clusters.

In order to explain the dynamic nature of the craft beer industry in Northern Colorado, this study will rely upon the traditional assumptions placed on industry clusters by Porter (1990, 1996, 1997). The cluster concept has been used extensively in local economic development planning. Due to their widespread application, it is important to understand the precise definition of industry clusters rather than relying on the broader term of agglomeration. Agglomeration typically refers to the benefits that stem from firms and people locating near one another, whereas this study focuses on the more dynamic term “industry cluster” as defined by Porter (Glaeser, 2010; Porter, 1996).

The terms industry clusters and agglomeration both provide insight into a firm’s geographic sense of place and both rely on the idea of economies of scale—a concept that has a long history in economics. With agglomeration economies, the primary advantage comes in the form of reduced transportation costs. This includes the costs associated with moving goods, people, and idea. Industry clusters, by contrast, focus on continual innovation and the transfer of information (Ellison, Glaeser, & Kerr, 2010). The two deviate from one another in the sense that the term agglomeration economy is viewed as a static concept focused on costs, whereas industry clusters are more dynamic concept created to capture the evolving complexity surrounding these phenomena (Deller & Marcouiller, 2004).

Studies of firm placement have led to the conception of industry clusters, an advancement on the broader notion of agglomeration economies. Clusters were observed early on due to their inherent nature of having their level of competitiveness tied to the performance of local firms and factors. Accordingly, industry clusters are defined as a group of interconnected firms in a related field that are confined by geographic parameters. This group includes specialized suppliers, service

providers, related firms, and associated institutions in a particular field (Doeringer, 1995; Porter, 1996, 1997).

The premise of a study completed by Kukalis (2010) was to investigate whether or not firms located within an industry cluster outperform those that are not. He discovered that these industries revealed no significant financial differences between clustered and non-clustered firms in the early stages of the industry life cycle. However, firms not located in a cluster outperformed their clustered counterparts in the late stages of the industry life cycle. Though the study was limited to a specific industry, its findings may be generalizable to other industries as well. In theory, the clustering of an industry is beneficial to the many entities involved.

Porter's Diamond Model

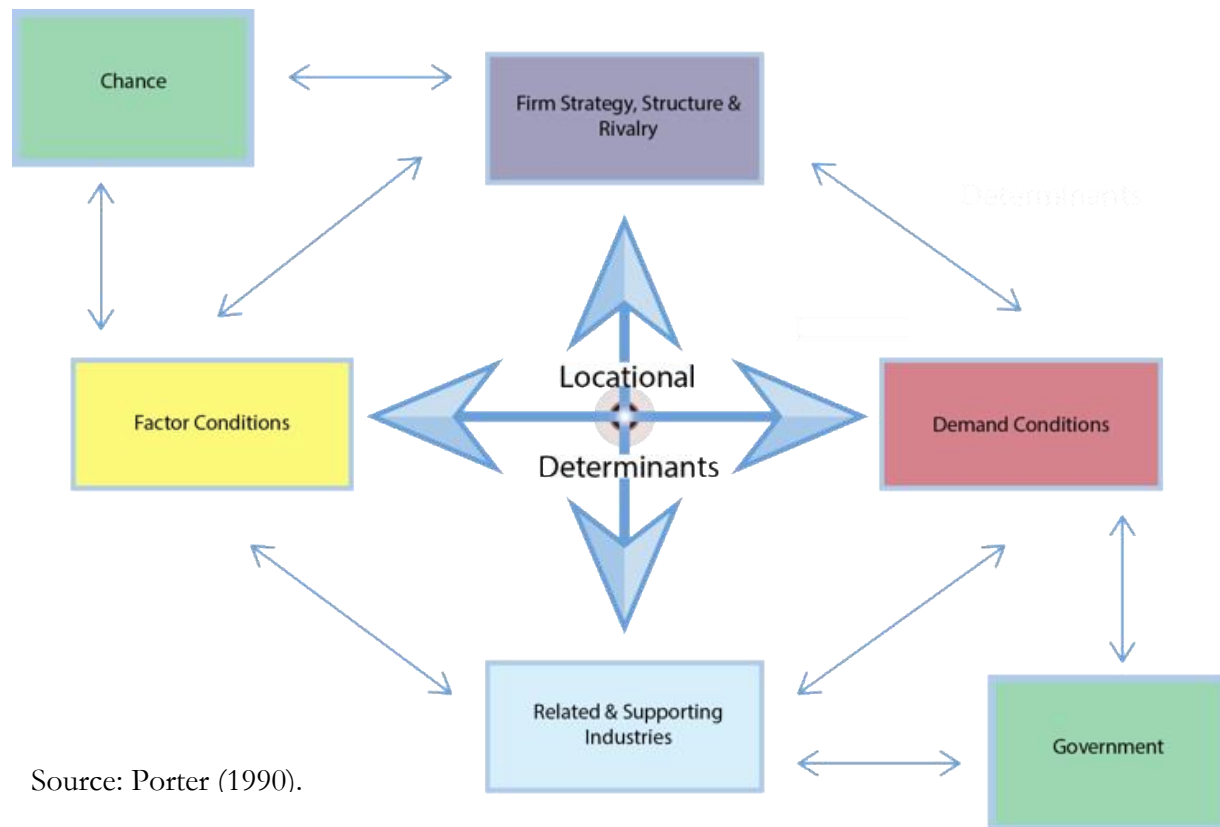
In his book titled "The Competitive Advantage of Nations," Porter (1990) presents a theory to explain the reason some countries are more successful in particular industries than others. He identifies four determinants that provide the conditions that establish a nation's national competitive advantage. Additionally, he proposes that government policy and chance, which act as exogenous shocks, support the system of national competitiveness (see figure 3.1).

The four locational determinants of Porters Diamond Model are:

- Factor Conditions,
- Demand Conditions,
- Related and Support Industries,
- Company Strategy, Structure and Rivalry, and

Porter's thesis posits that these factors interact with one another to foster improved business conditions where innovation and competitiveness is exhibited. The term competitive advantage was used to explain the reason particular industries become competitive in their given location. Here, Porter defines competitiveness as a measure of productivity, and places emphasis on the microeconomic foundations that create a competitive advantage.

Figure 3.1. The Porter Diamond.



Firm Strategy, Structure & Rivalry

Porter (1990) defines this factor as the conditions within the defined area that guide how companies are created, organized, and managed. Every environment incorporates a different systematic approach in the way it conducts its business sectors. It is this disparity that governs the way firms compete in their respective areas and gives them their competitive edge. Another key concept in this component is the nature of domestic rivalry. Porter identifies rivalry as a driving force behind competitive advantage. He asserts that domestic rivalry forces firms to compete on multiple fields including cost, quality and innovation (Porter, 1990).

Binding these firms together is an open channel of business transactions and communications, which allows information to flow more efficiently (Deller & Marcouiller, 2004). The driving force behind industry clusters is competition; but even though many of the firms involved in this geographic paradigm are often engaged in competition, they realize that they share common opportunities and threats as well. This unique quality allows clusters to continually evolve.

Players involved in a given cluster push one another through competition but also support one another with ideas and shared resources. This cycle of information causes innovation and the transfer of knowledge (Porter, 1990).

Demand Conditions

According to Morosini (2004) incorporating the social fabric that underlies industrial clusters, and not solely focusing on the traditional economic perspective, may be beneficial to fully understanding the success of a given cluster. Ellison, Glaeser & Kerr (2010) indicate that proximity to customers is one of the primary reasons why firms locate near one another. The nature of the market for a particular service or good is the focus of demand conditions. Those willing to purchase a good must be in close proximity.

Porter (1990) emphasizes the importance of local demand, and he indicates that this asset creates a competitive advantage. Together the size and the sophistication of local demand are vital to the success of a cluster. From this, firms are able to respond to buyers needs in a personalized fashion. This forces the cluster to innovate and upgrade their competitive positions to meet the high standards in terms of quality and service demands (Porter, 1990; Smit, 2010).

Related & Supporting Industries

Having access to related and supporting industries is a major component of the cluster concept. Within the definition of industry clusters, Slaper (2015) asserts that clusters are a network of economic relationships that create a competitive advantage for any related firms in the same location. Furthermore, similar business and suppliers are incentivized by this competitive advantage and may decide to relocate or move to the area. Ellison, Glaeser & Kerr (2010) indicate that proximity to suppliers is one of the major reasons (along with proximity to customers) why firms locate near one another.

Porter (1990) postulates that the local presence of supplier and related firms plays a major role in minimizing costs. Firms are able to improve their production process and increase their efficiency with the support of supplementary businesses. Clusters benefit from resource-driven specialization and economies of scale (Smit, 2010). The external economies of related and support industry clusters become the true source of competitive advantage (Porter 2000, 2003). This includes specialized input providers, institutions, and the spill-over created by local competition. The cluster

spurs learning, innovation, and operating efficiency—important features of virtually any advanced economy (Porter, 2000, Porter, 2003, Smit, 2010).

Factor Conditions

Shaffer, Deller and Marcouiller (2004) link a firm's location to regional uniqueness. They base regional competitive advantage on the productivity and availability of primary factors of production. Within traditional trade theories, factor conditions include land, labor and capital. Porter (1990) further classifies this factor, breaking it down to include: human resources, physical resources, knowledge resources, capital resources and infrastructure. Furthermore, he differentiates factor conditions by dividing them into basic and advanced factors, which are specialized or general. Advanced factors are production factors that are acquired over time. Through a cycle of innovation, advanced factors can become specialized. Basic factors are inherited, thereby requiring far less effort or investment in order to be utilized in the production process. This includes raw materials, water resources, and unskilled labor.

Ellison, Glaeser & Kerr (2010) further define the theory of industrial clusters. The study indicates that proximity to labor market pooling and natural advantages are the primary factors. Their analysis concludes with strong support for Marshallian theories of agglomeration, as they find consistent evidence for each of the three mechanisms—cost reduction associated with transporting goods, people, and ideas. The factors in question yielded a stronger effect on coagglomeration patterns than shared natural advantages.

Researchers Dewally and Shao (2014) were able to shed light on the factors that lead to a firm's decision to locate in an industry cluster. The study suggests that firms may decide to co-locate in an industry cluster in hopes of capturing the positive externalities associated with input sharing, labor pooling, and knowledge spillover, three sub-factors of the locational determinants. The study found that firms that locate within an industry cluster are more apt to maintain the benefits of innovation in asset turnover than firms not located in the industry cluster. Moreover, they found that it appears that firms are better able to benefit from input sharing and labor pooling than they are from knowledge spillover.

In a study titled “New Growth Theory, Technology and Learning,” Cortright (2001) emphasizes the importance of knowledge in economic development. Within his research Cortright argues that the ability to grow the economy by increasing knowledge as opposed to focusing resources on labor or capital generates nearly boundless growth opportunities. Left to their own

devices, markets will, more often than not, fail to produce enough knowledge because innovators cannot capture all of the gains associated with creating new knowledge. Because of the marginal costs associated with the reuse of knowledge, firms who utilize a knowledge base in their production process can earn quasi-monopoly profits. Overall, all forms of knowledge exhibit properties that contribute to growth. History, institutions and geography all shape the progression of these knowledge-based economies.

Morisini (2004) a researcher from the International Institute for Management Development in Lausanne, Switzerland presented a model to back the argument that both the degree of knowledge integration between an industry cluster's agents and the scope of its economic activities play a key role in its overall competitive advantage. In contrast to the traditional neo-classical assessment of clusters, which focuses primarily on the advantages of spatial location, this study views clusters as social entities specializing in the creation and transfer of knowledge. By employing a knowledge-based classification of industry clusters, the study was able to offer an additional dimension to the study of industry clusters. Morosini 's study highlights the many social dimensions that are key to understanding the unprecedented economic success and unique competitive advantages that many modern industry clusters have come to realize.

Analyzing Clusters

Porters Diamond model is not the only approach to cluster analysis. There are numerous types of analyses aimed at identifying industry clusters and assessing cluster performance. Stimson, Stough, and Roberts (2006) offered an approach to measure regional inter-industry linkages –a vital aspect of understanding the strengths of a given industry cluster. Input-output analysis (I/O) is a methodology for this modeling framework. Its primary purpose is to model the interdependence among industrial sectors in an economic system. Underlying an I/O analysis is a set of accounts detailing a multitude of transactions between industrial or economic sectors.

Feser and Bergman (2000) suggest an alternative means of identifying potential clusters in subnational areas by utilizing available information on national interindustry linkages. Through input-output analyses on linkages, the study was able to present a template to represent important alignments of detailed sectors. By applying this template to the manufacturing sector in North Carolina, it was determined that, with more development, it may be possible to apply such a methodology to approximate a grouping of firms that are likely to interact with one another both formally and informally.

Researchers from Chung Hua University and Chiao Tung University developed an approach to determining national and comparative advantage by applying the system dynamics (SD) methodology to explore factors affecting the industrial cluster effect (Lin, Tung & Huang, 2006). They take the position that the SD is the most effective methodology available. Through the cause-and-effect chain, the researchers were able to establish a dynamic model of factors that depict the industrial cluster effect based on four important interactive dimensions of competitiveness: manpower, technology, money, and market flows. The SD approach was ultimately adopted to analyze the complicated relationship of factors affecting industrial cluster effect. The analysis described above are only a few of many available analyses. Much research is available on the study of industrial clusters.

Clusters and Economic Development Policy

Slaper (2015) emphasizes the importance of cluster development in modern economic development theory. His study found that not all clusters are created equal in terms of employment effects, and that the issue of targeting one cluster over another is greatly dependent on the supply chain and workforce requirements. According to Shaffer, Deller & Marcouiller (2004) community economic analysis is a subgroup of community development that highlights the economic rather than the social-political-environmental aspects of a given area in order to examine how a community is put together economically and how it responds to both external and internal stimuli.

Doer and Terkla (1995) have found that, although industry clusters offer new way for local communities to leverage economic development policies, the current trend of defining industry clusters in an ad hoc way limits its potential. This fault is leading to wasted development resources because communities are failing to see vital linkages among firms that cross over to other industries. Their study suggests that local economic policies need to consider the dynamic nature of cluster potential that exists between specific firms and regional economies. They believe that local government needs to focus on finding partners for existing firms, recruit firms that have alliance strategies, and take advantage of intangible regional resources that reflect externality benefits to multi-industry firm clusters (Doer and Terka, 1995).

According to Feser (2004) there are four implications for policy in regards to industry clusters. Clusters can be used as an allocation strategy. This is when policy focuses resources on identified competitive clusters in a limited number of regions and industries. Additionally, clusters can be used as a unique development strategy. Here policy is aimed at promoting networking among

clustered firms in an industry or coordinating a set of strategies to encourage competition within a regional cluster identified through a cluster analysis. Clusters can also be used as an organizing device. The cluster concept can be used to facilitate economic development strategic planning efforts. Finally, clusters can be used as a means of implementation. Using applied cluster analysis as a guide, a redesign of development initiatives can be made using cluster dynamics.

Applying tools of economic development can aid in job creation as well as business retention and expansion efforts. It can also ensure that dollars made inside a community, stay within the community. Cluster development is a major tool in achieving these aims and stimulating the local economy. If a region can better understand whether a key industry is positively benefiting the local economy and causing a positive ripple effect throughout other industries, then local resources can be put to better use. However, because of a lack of specificity regarding the cluster concept, resources are often wasted. Therefore, understanding the role of proximity in an industry cluster can lead to better use of the cluster concept in the future.

Chapter 4 - Research Design

This study of industry cluster emphasizes the importance of localization in each individual factor of a cluster. The four attributes of the Porter's Diamond Model help us to both identify and analyze the key interactions that trigger local competitiveness. This assessment will, in turn, aid policy makers as they set out to create strategies for economic development based on the elements that determine a competitive advantage. Adapting Porter's diamond model to analyze a given industry cluster can enable regions and their firms to identify best practices that may ultimately foster a competitive advantage.

The common resources and capabilities of a cluster are, more often than not, constrained by geographic proximity (Kukalis, 2010). The scale of geography related to a given industry cluster can vary widely –from a nation to a region (Porter, 1990, 1996). Though Porter's original cluster work was applied on a national scale, his subsequent works were based on states and regions (Porter, 1996, 1997). Ohmae (1995) argues that regions are replacing nations as the engines of economic growth. Though it was intended to gauge the competitive nature of an industry on a national scale, Porter's work has influenced how we think and analyze both the business performance and economic development of regions. Stimson, Stough & Roberts (2006) suggest that Porter's diamond model provides a helpful framework that aids us in our strategic thinking of regional and community economic development.

Morisnini (2004) points out an important aspect of urban agglomerations: it leads to localization economies of scale. Geographic proximity creates special economic benefits for specific industries, and this notion is key in defining industry clusters. According to multiple sources of economic development theory and practice, all of the factors within Porter's Diamond model rely on a sense of spatial proximity (Stimson, Stough & Roberts, 2006; Deller & Marcouiller, 2004). However, there is no specific description of the level of spatial proximity required in each determinant.

Many organizations and authors have recognized the craft brewery industry as an important cluster in Colorado (Marturana & Shields, 2011). As such, the main purpose of this study was to reveal if geographic proximity is vital in the four points of Porter's Diamond that give the brewery cluster a competitive advantage as expressed by Porter (1990). I also analyzed the specific geographic scale at which these determinants are operating in this cluster. As shown by figure 5.1, I used various scales of geography to aid in understanding the significance of proximity in each point of the

diamond—the smallest being localized activities occurring within city limits, and the largest taking place across the nation.

Figure 5.1. Various Geographic Scales

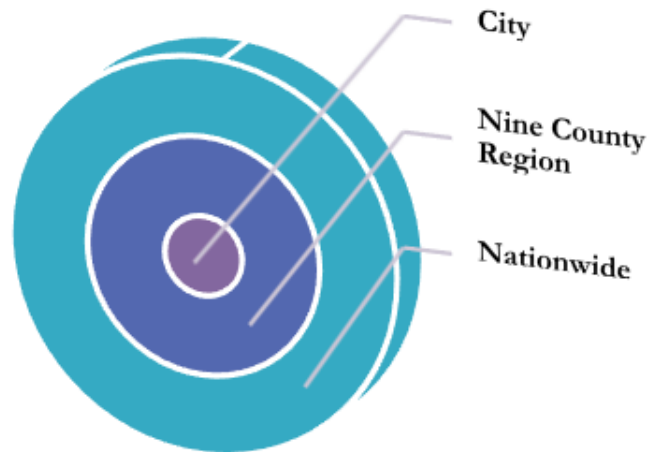


Figure 5.1 breaks down the different geographic levels relevant to this study. For the sake of simplicity, I will focus on three levels of geography based on those used in the various definitions of the craft beer industry discussed in earlier chapters. The smallest scale will be demarcated by city limits. For example, many activities were occurring in Fort Collins and did not spread beyond the city. The next level is the nine county area that includes Northern Colorado and Metro Denver (figure 2.1). This area serves as the intermediate level showing activities operating in the region defined by the Metro Denver Economic Development Agency. These activities stretched beyond local boundaries but were still occurring within the cluster area. The next geographic scale includes anything out of the cluster area. Included are the activities occurring in the state but out the cluster area as well as throughout the United States. I do not differentiate between greater Colorado and the rest of the United States because activities occurring in this area are occurring outside of the cluster area, thereby not adhering to a sense of localization.

I tested four null hypotheses related to the four points of Porter's Diamond to determine whether local factors were important and at what geographic scale they were relevant.

In order to form a successful cluster:

- i. Factor conditions must be kept locally confined to the region
- ii. Local demand conditions are necessary
- iii. Supporting and related firms must be located within the region
- iv. Influence to firm strategy, structure, and rivalry is driven by related firms only in the region

Throughout this exploration of the craft beer industry, the assumption will be made that locational determinants must be confined within a distinct set of geographic parameters as outlined earlier in this chapter, and that stretching beyond these boundaries constitutes a determinant that does not adhere to the traditional definitions of cluster theory. Notably, each hypothesis was tested through a combination of interviews and public economic data, with the former being the guiding factor.

Factor conditions must be kept locality confined to a region

Factor conditions refer to a region's position in relation to its access to its factors of production. This includes: land, infrastructure, labor, financial capital, technological infrastructure, and access to public goods and services. To explore this point, I examined the factor conditions within the industry through the use of public economic data. I also relied on interviews with breweries within northern Colorado to uncover information on how resources are being utilized in the production process. Due to its large scope, I focused access to capital, physical infrastructure, technological infrastructure, land, and labor.

Economic data on the local labor force and local level of education was retrieved from the Bureau of Labor Statistics as well as the United States Census Bureau: American Fact Finder. This was used to get a broad sense of the specialization within the workforce in Northern Colorado. In addition, secondary data was used to find what public goods and services are locally available; what financial institutions are present; and what resources may be readily available in the area –as they may apply towards the craft beer industry.

To get a more in-depth look of how firms are utilizing local resources, I spoke with local firms. The goal here was to understand if factor conditions of this particular cluster are confined to the region, or if these firms are utilizing resources from areas outside of Northern Colorado.

Access to Capital: To discover whether access to capital is readily available within the region, I spoke to local firms to discuss where the majority of their finances come from. My goal was to find an answer to the question: are these firms utilizing local financial institutions, or are they seeking funds elsewhere.

Physical Infrastructure: The process to analyze the region's physical infrastructure was twofold. First, I assessed the area for physical infrastructure through city websites to uncover the physical infrastructure present in the region. With that information, I spoke to firms to see if access to infrastructure (primary in the form of transportation system) was a determining factor for their location decisions.

University and Market Knowledge: This section includes local universities role in the craft beer industry. Through interviews with local brewing firms, perception about Colorado State University's Fermentation Science program (and related programs in the region) was collected and related back to the cluster's competitive advantage. It was important to evaluate the connection between universities and the industry because of the potential benefits such as increased technology and an increase in market knowledge.

Land: To assess the conditions of local land, I relied on my discussion with craft beer employees. I discussed the inputs within the production process, such as water, hops, malt, yeast, and wheat. As essential ingredients in beer brewing, learning the location of these inputs was vital to understanding the role of geography. Are brewers able to get these resources in of the region, or do they have to import from other areas?

Labor: United States Census Bureau, County Business Patterns provided the workforce data and economic data related to labor. Fort Collins was assessed through location quotients, in order to compare the concentration of employment in craft beer industry in the city to the employment in the nation. Speaking with local breweries also aided this assessment. These interviews provided insight into the region in terms of specialized labor, and allowed me to determine if breweries were able to meet workforce demand from within the region or if employers may have to meet workforce demands by recruiting qualified individuals from outside of the region. Also, it determined if graduates from CSU's fermentation science are providing the specialized labor needed to support the cluster.

Local demand conditions are necessary for a successful cluster.

The social environment was believed to play a key role in the success of the craft beer industry in Northern Colorado. Because of this, I thought it would be beneficial to not only cover the economic implications of the beer industry, but also incorporate the role of the outlying community in terms of social structure. Demand conditions were based on the underlining social fabric of the area including the local culture, the customer base, and any unusual local demand in this specialized market segment. To evaluate this hypothesis, I analyzed local demographic conditions and spoke with firms to uncover information on their target market, who their largest consumers are, and whether the demand for their product is local.

Information to gauge this factor also came from various sources of secondary data. Demographic data was accessed from the United States Census Bureau. Additional information was pulled from various other publicly available sources such as news articles. Finally, I spoke with local breweries to see if their customer base is comprised of locals or tourists. This was done to see if the proximity of people willing to buy craft beer matters to these firms, or if they rely on exporting their product to other areas.

Supporting firms must be located in close proximity in order to drive cluster productivity.

To test this hypothesis, I spoke with local breweries to identify any local overlap or sharing occurring in the production process. The interview questions looked to uncover local manufacturing, distribution, marketing, and suppliers that are shared within the industry. Any additional information that supports this factor was provided by secondary data. To assess the related and supporting industries within the craft beer cluster, questions were based on industries that are directly related to or support each other, access to suppliers which provide cost effective input shared between competitors, the effective utilization of inputs, innovation and upgrades to suppliers, and related industries which firms can coordinate activities with when competing with one another.

Local firm structure and rivalry is giving this cluster a competitive advantage.

To test this hypothesis, I relied on information provided by interviews. To assess firm strategy, structure and rivalry, it was also important to understand how companies in this industry are created, organized and managed, as well as to learn more about domestic rivalry. This was achieved by holding one-on-one interviews with craft beer business employees in Fort Collins, Co. The interview questions were geared towards information on the firm's strategy, objectives, management breakdown, and their outlook on rivalries.

Firm Strategy & Structure: Here, I spoke to firms to see if the conditions in the region have altered their approach to strategy. I also spoke to firms to see if conditions in the region have made them adjust their approach to company management.

Rivalry: According to Porter (1990) competition is the driving force behind a region's ability to achieve a competitive advantage. First, I gauged the competitive environment by identifying who breweries perceived as their main competition. Subsequently, I uncovered if these rivalries are driving individual companies to innovate or accommodate local demands through an increase in quality or service changes. The final step was to gain the breweries perspective on influence, and if they were influenced by local breweries to push innovation and evolve their production processes.

Interview Process

I conducted a total of eleven interviews. The breakdown of participants is shown on figure 5.1. Six of the participating breweries are located in Fort Collins. Two of the breweries are located in smaller adjoining cities just south of Fort Collins in the cities of Berthoud and Loveland (both in the Fort Collins Metro Area). One of the participating breweries is located in Greeley. The aforementioned ten participants are all situated in the region referred to as Northern Colorado. Additionally, one of the participating breweries is located in Boulder, which is often grouped under the Metro Denver Area.

Subjects were key players in breweries throughout the study area, this included high-level employees such as: CEO, Owner, Co-Owner, Founder, Brewery Manager, or Head Brewmaster. Breweries were identified through a simple web based search. Subjects were initially contacted via email and asked to partake in the research study via phone or email. A total of twenty-five breweries were contacted. There are a total of seventeen breweries in Larimer and Weld County –all were contacted. The remaining breweries that were contacted were located in the Metro Denver area.

The breweries that agreed were informed that confidentiality would be upheld if they preferred not to be named. Confidentiality of the respondents will be upheld and no mention of individual employee names will be provided in this document. Only the name of the brewery will be mentioned.

Interviews were primarily open-ended questions in the areas outlined earlier in this chapter. Each participant was asked a total of fourteen questions. Follow up questions were asked if the interviewee did not fully address the question. Conversations during the interviews were documented via notes and coded for key themes and information. They were not recorded.

Participants were debriefed verbally before the beginning of the interview. They also received a letter outlining the purpose of the research, the content of the interview and ways to contact the researchers. If participants indicated they would like to see the results of the research, the final report will be sent to them.

Every participant seemed very eager and open to discussing their operations and their perception of the regional environment. Even though participants were given the option to skip questions if they felt it revealed too much about competition, none of them did. All questions were answered fully and taken into account in the analysis. Table 5.1 provides the breweries that participated in this study, and their location.

Table 5.1. Interview Subjects and Breweries

Brewery Name	City
Equinox Brewing	Fort Collins
Zwei Brewing Company	Fort Collins
Horse & Dragon Brewing Co.	Fort Collins
Pateros Creek Brewing Co.	Fort Collins
New Belgium	Fort Collins
Odell Brewing	Fort Collins
Berthoud Brewing Co.	Berthoud
Boulder Beer Company	Boulder
Wiley Roots Brewing Company	Greeley
Crow Hop Brewery	Loveland

Coding

Analyzing the data involved identifying key themes such as the location of major competitors, key ingredients, important partnerships, and the perception of local factor conditions. Seven of the interviews took place via telephone. The remaining five were completed through email response. During telephone interviews, thorough notes were taken in order to eliminate the need for recording. Email respondents were presented the same questions as phone interviewees, and follow up questions were asked if key information was missing from their response. All interviews provided relevant information, and all interviews were deemed valid and used in the analysis of this study. Interview questions were not sorted by the points in Porters Diamond but by broader themes that would allow the conversation to flow better. Questions were applied to null hypotheses during the subsequent cross-case analysis.

After all eleven were completed, an in-case analysis was conducted. An in case analysis focuses on each individual interview, treating them separately. Here, I sought themes and sub-themes based on questions within each interview. The goal was to identify key themes relating to the significance of geographic proximity in each locational determinant. During this analysis, geographic proximity was explored according to individual breweries. Proximity was classified as essential to a given factor if the brewery stated that the activity was occurring within the cluster area (inside the nine county area). It was classified as inessential if the activities were occurring in the state, but outside the area or on a nationwide scale. Additionally, I identified the geographic level for each factor according to individual breweries. Geographic levels were sorted into three different categories 1) city 2) nine-county area and 3) nation. During this initial analysis, important quotes were also identified.

Following this, a cross case analysis was conducted. During this process, I looked for broader themes and subthemes that stretched across all interviews. During this analysis, I sought the specific number of breweries that identified themselves with a specific theme to determine if geographic proximity was significant. Geographic proximity was deemed as either essential or inessential based on the number of breweries justifying its significance. Proximity in a given point of the diamond was classified as essential if six or more firms stated that the activity was occurring within the cluster area. This is more than fifty percent of the interviews. I also compared the different geographic levels that each factor was operating at across interviews in order to make an overall generalization about the specific geographic scale significant to each factor. In order for the

specific geographic level to be determined, a minimum of six out of eleven breweries had to state that an activity was occurring in that same level.

Stopping Procedure

The study ceased when all the four factors of Porters Diamond were assessed, and I deemed the amount of data collected as sufficient in order to draw a conclusion. This meant there were a minimum of ten interviews with key players involved in the cluster and that each interviewee answered questions in their entirety. Additionally, each interview made a contribution to find the degree to which the craft beer industry adheres to the concept that grounds cluster theory (a system that emphasizes geographic placement) within individual components of Porters Diamond.

Limitations

Since the implications of the cluster concept vary between industries, the limitations regarding the results of this study are clear. The firms studied were confined to the craft brewing industry in Northern Colorado. Thus, the scope of this study limits the generalizability of its implications to other industrial clusters. As other researchers have pointed out, clusters are often defined in an ad hoc ways, thus missing important connections to other industries (Doeringer & Terkla, 1995). Focusing this case study on craft beer presents an opportunity to provide an in-depth look into a specific sector; however, it may fail to represent vital links and connections present in the region. Missed connections may mean missed opportunities to strengthen economic development policy, as they may offer more insight into cluster formation and development relevant to the cluster concept.

Chapter 5 - Analysis of the Craft Beer Industry

The interview process outlined in the previous chapter provided great insight into the role of geography in the craft-brewing cluster. Over the course of two weeks, interviews were held with eleven different brewery employees. Through each interview, I gained much knowledge over the industry. Every participant offered important information that I used in the final analysis.

As mentioned earlier in this report, I believe this may aid future economic development efforts. Policies are often limited by resources constraints, such as monetary, labor, and time. Thus, having a more understanding of the role of geographic proximity within a cluster may steer policy into a better direction. I categorized the interview responses by the four cluster components.

The following analysis explores the role of geographic proximity in the craft beer segment of the brewery cluster in Northern Colorado. This is done by testing whether the geographic dimension was necessary in all four points of Porter's diamond in the creation and operation of the craft beer industry. Initially, I intended to study only whether or not proximity was important to each point of Porter's diamond when broken down into smaller sub-factors. However, after the first few interviews were conducted, I came to realize that the locational determinants in the craft beer sector were operating at different geographic scales—some occurring more locally, and others within a broader nine county region. The classification of the craft brewery sector is inconsistent between definitions, with different organizations defining the cluster within different industries and in different locations. As such, in addition to investigating if place is vital in each locational factor, I explored the level of geography significant to each factor.

Table 6.1. Overview of Interview and Secondary Data Analysis.

Locational Determinant		Significance of Proximity	City	Multi-Region	Nation
Factor Conditions			within cluster area		out of cluster area
advanced	Infrastructure				
	<i>Transportation</i>	Essential	X		
	Human Resources			X	
	<i>Specialized Labor</i>	Essential			
	Knowledge Resources			X	
basic	<i>University</i>	Essential		X	
	<i>Market Knowledge</i>	Essential		X	
	Raw Materials				
	<i>Grain, Hops, Yeast</i>	Inessential			X
	<i>Water</i>	Essential		X	
	Human Resources				
	<i>Unskilled Labor</i>	Essential	X		
Local Demand Conditions					
	Community Traits				
	<i>Demographics</i>	Essential		X	
	<i>Customer Base</i>	Essential		X	
	<i>Sophisticated/ Demanding Buyers</i>	Essential		X	
	<i>Culture</i>	Essential		X	
Supporting Firms					
	Connections				
	<i>Organizations, Partnerships</i>	Inessential	X		X
	<i>Related Firms</i>	Essential	X		
	<i>Supporting Industries</i>	Essential	X		
Firm Strategy, Structure, Rivalry					
	Business Environment				
	<i>Firm Strategy and Structure</i>	Inessential		X	X
	<i>Firm Rivalry</i>	Essential	X		

Factor conditions must be kept locality confined to a region

One of the guiding principles of this locational determinant suggests that specialized factors contribute to a clusters competitive advantage. Specialized factors include skilled labor, capital, and infrastructure. Conversely, access to raw material and access to unskilled labor are considered basic factors, or ones that require little to no investment to be utilized in the production process. Therefore, they do not help to sustain a regional competitive advantage (Porter, 1990). To assess the role of geographic placement in this locational determinant, both interviews and secondary data were used. In addition, the determinant was broken down into smaller factors, which could be assessed independently. Because it was important to gauge different levels of geography, the term *multi-region* was used when referring to activities or assets within the cluster area (Denver Metro and Northern Colorado), and the term *local* was used when referring to activities within city limits.

Advanced Factors

Transportation System: Interviewees were asked to assess the region in terms of the transportation system and related infrastructure. This included modes of transportation as well as roads. On one hand, their evaluation of regional infrastructure that entailed a discussion directed towards interstate highway systems, major roads, or the ease of access in and out of the region, created a mix of positive and negative reactions. On the other hand, their overall perception of local infrastructure, in terms of transportation modes, was mainly positive. Likewise, a majority of the firms believed that local infrastructure such as alternative transportation aided the craft beer industry more so than regional infrastructure such as interstates or airports. According to these breweries, local infrastructure allowed beer tourism to flourish, giving visitors the opportunity to jump between breweries on alternative modes of transportation. Alternative transportation also helps beer tourism—a major aspect of the beer culture in the area.

Regional transportation consisted of a discussion involving interstate highway systems that connect cities within the region (I-25 and I-80), as well as major arterial roads. These major roadways provide access between cities and allow ease of access in and out of the area. This can aid the logistics involved in importing and exporting goods. Out of the eleven interview participants, only four stated that road infrastructure in the region was good. One CEO of a brewery in Fort Collins indicated that the region's infrastructure would be rated a "D" at best. The respondent went on to discuss the limitations of the regions interstate system, observing that Fort Collins only has

limited access via the interstate, a trait that causes traffic and congestion problems, especially with population numbers quickly rising.

Despite being the most populous municipality in the state and having a surplus of business resources, only one interviewee noted the importance of Denver as a major transportation hub for the craft beer industry. This same interviewee, however, also stated that regional infrastructure was not a major consideration for their location in Fort Collins. Many of the interviewees had a similar take on regional infrastructure in terms of roads, affirming that this element of factor conditions did not bear much weight in their decision to do business in the region.

Local infrastructure included alternative modes of transportation such as pedestrian walkways, bike paths, and bus routes—enabling localized transportation within the city limits. Nine of the eleven interviewees perceived local infrastructure in their area as supportive of the beer industry. All nine of these interviews were with breweries in either Fort Collins or Boulder. Those interviewed claimed that their respective communities offered a variety of alternative modes of transportation. Two interviewees were bold enough to say that although drinking and biking is illegal, it is a preferred choice of many beer drinkers that come to the area to partake in the craft beer culture. One said “The city being bicycle friendly is supportive of beer drinkers.”

The remaining two breweries (that claimed a lack of local transportation infrastructure) were located in the smaller communities of Berthoud and Greeley. Both of these interviewees noted a lack of bicycle paths and bus routes. Notably, these two communities do not partake in the beer tourism aspect of the craft beer industry, as discussed during their interviews. For these outlying communities, transportation infrastructure was deemed as “below average” but “growing” both on the regional and city geographic scale.

According to the City of Fort Collins, the League of American Bicyclist named the city as a Platinum Bicycle Friendly City (“FC Bikes Program,” 2014). New Belgium was awarded the same designation, making it the only other entity in Colorado to receive this distinction. In 2014, the city implemented a program to encourage more people to travel by bicycle and to do so safely. The program assembles bicycle encouragement events, which offer bicycle education lessons, free helmets, free reflective stickers, and sells related merchandise. The city also started a bike library checkout program in order to increase ridership (“FC Bikes Program,” 2014).

The City of Fort Collins also has a comprehensive bus program offered through Transfort, one that prides itself on allowing people to travel anywhere in the city. It encompasses three transit centers providing access to twenty-one connecting routes. It also offers a special Friday and Saturday

late night route, named aptly after the colors of CSU, to accommodate those partaking the local “beer culture.” Through this program, students of CSU ride free. The bus system has also adapted to the bicycle community, offering a *bike’ n’ ride* program that allows bicyclists to safely store their bikes and finished their commute via bus (Transfort, 2014).

Together these local assets help to transform the City of Fort Collins into a pedestrian friendly environment. They also, perhaps inadvertently, aid the craft beer industry (according to all seven interviews with local brewers). The Head Brewmaster of one major brewery described a similar environment, stating that the city is very bicycle friendly and offers a comprehensive bus system. Both of these aforementioned cases highlight the possibility that transportation infrastructure operates at a different geographical scale. Regional geography may not play a crucial role in the formation of all clusters. A well-established network of city transportation helped to pave the way for the craft beer industry.

Although the beverage production cluster is defined by two metropolitan areas (nine counties), transportation infrastructure seems only relevant in terms of the underlying city. The majority of the firms did not take the regional transportation system into account when locating to the area, and if they did, it did not carry much weight in their overall decision –at least not enough to persuade them otherwise. If one of largest breweries in Fort Collins thinks the regional transportation “stinks” then perhaps it is time to reevaluate what makes a cluster thrive.

Human Resources

Specialized Labor force: Another element of factor conditions is skilled workers. For this, the interviewees were asked to assess the region in terms of specialized labor and whether or not they believed the region provided local breweries with the employees needed for beer production. In the world of craft beer, a specialized workforce is vital in several aspects of the manufacturing process. Breweries need engineers, business professionals, and brewers. Theorized by Porter (1990), advanced factors such as skilled labor are created and upgraded through reinvestment and innovation to specialized factors, which provide the basis for the competitive advantage of a region.

According to the interviews, only two of the eleven breweries believed that the region did not provide a sufficient workforce in terms of skilled labor, forcing these firms to search for skilled labor on a national level. These aforementioned firms were two of the largest in the cluster. In order to meet their workforce needs, they had to turn to breweries from around the country. This may be attributable to different sets of needs in terms of the required duties needed at larger craft breweries

or due to the competitive nature of the industry, as noted by one interviewee. Other than these two cases, breweries were able to meet their specialized work force needs from within the region.

The city itself was often not a sufficient supplier of specialized labor demands, and often times firms noted that they had to bring in talent from Denver or they looked to graduates of CSU's program. Because of this, the broader scale definition of that encompasses multiple regions (Denver Metro and Northern Colorado) was more applicable for this aspect of factor conditions, as breweries often focused their discussion of hiring from multiple regions in the area rather than on their specific county, city or community. The geographic scale of operation is more significant when discussed in terms of the beverage production cluster (Denver Metro EDC, 2015).

Knowledge Resources

University and Market Knowledge: There is a strong inherent link between the breweries in Fort Collins and Colorado State University (CSU). Accordingly, it was important to assess the area in terms of education because education plays a major role in developing the local workforce—outputting workers with specialized skills that can lend a hand in cluster development as mentioned above. Equally, market knowledge can stimulate innovation and push players in the cluster to be more competitive. As suggested in cluster theory, human capital (expressly in terms of knowledge and education) plays a major role in the craft beer industry in Northern Colorado. When speaking with brewery employees, higher education, particularly Colorado State University, was a major topic of discussion.

At the core of the craft beer industry in Northern Colorado are a strong sense of connections, linkages, and networks that bond all employees involved in the cluster together. Colorado State University is a great illustration. The university offers a Bachelor of Science in Fermentation Science for those interested in working in the brewery field as a profession. Additionally, the university works closely with breweries in the area, not only to develop a specialized workforce, but also to develop new technologies and practices in the field of brewing.

The strong connections supporting the industry are exemplified by activities between this institution and the breweries. Over the years, several donations have helped the department: many of the contributors hope that the program will better prepare graduates with the necessary education to enter the regional labor force as skilled brewers. Breweries in the area are so adamant about helping to advance the craft beer industry in the region and develop the region's human capital that in 2015, New Belgium donated \$1 million dollars and in 2014, Odell Brewing Co. donated \$100,000

to the Fermentation Science and Technology program at the university—this was in addition to past contributions that they made (Dodge, 2014; Sexton, 2015).

Gestures such as the substantial donations given to CSU showcase the strong partnerships that exist in this industry, and the importance that those involved put on forming a supportive network of social ties that strengthen community capitals. During an interview, one of owners of a Fort Collins brewery said, “it is an effort to support the craft brewing industry as a whole but I hope a positive byproduct will be that our brewery hires some well-trained CSU graduates as a result.” The department uses the funds for various upgrades such as purchasing new lab equipment.

Five out of seven of the breweries interviewed in Fort Collins stated that they have an ongoing relationship or partnership with CSU. During interviews, both New Belgium and Odell spoke of a tight relationship with the University. This partnership started long before the program was made official, during times when the university only offered classes based on fermentation science. These breweries, along with several others, offer internships to students enrolled in the program. This allows the specialized training needed in the craft beer industry. As suggested by one interviewee, “students graduate the program and are able to stay here and work for us.” Several other firms also noted that they, too, have hired graduates from that program. At New Belgium, several CSU graduates work in quality assurance and engineering.

CSU’s fermentation science program is not the only higher education offering craft beer specializations for the region. Interviewees mentioned a new program offered at Denver Metro College. In addition, CSU also offers a certificate program aimed towards the business marketing side of beer. The demand of the industry is leading to the creation of programs focused on brewery manufacturing. In terms of the region having an adequate skilled labor force, as one interviewee put it “it is overkill.” “There is a lot of competition,” stated another.

In respect to the craft beer industry, this aspect operates at a larger geographic scale, notably the region includes Denver Metro and Northern Colorado. This was uncovered first by reviewing interviews with firms outside of Fort Collins. Breweries in Greeley, Berthoud, and Boulder all discussed the importance of CSU and their bachelor of fermentation science program. They commented on their brewery or surrounding breweries hiring graduates from the new program. Likewise, even though firms located in Fort Collins focused their discussion on CSU and its fermentation science program, several of them also mentioned that a new program at Denver Metro College will benefit them as well, and they look to hire graduates from that program once it takes

off. One of the major breweries in Fort Collins even mentioned a partnership with the Denver-based college.

Basic factors

Raw Materials: In order to fully understand cluster formation, I also explored the role of the elements that Porter (1990) claims are passively inherited and do not lead to a competitive advantage, basic factors. Basic factors include access to raw materials and unskilled labor. During interviews, breweries were asked about their production process. They were asked where their ingredients came from. For breweries, this included primarily yeast, malt, hops, wheat, and water. In addition, breweries were asked about the region in terms of skilled and non-skilled workers. They were asked of their perception of the regional unskilled workforce, along with where their employees are from.

I discovered that malt, hops, yeast, barley, and wheat stood true to Porters (1990) diamond model. Proximity and access to these raw ingredients does not play a vital role in cluster formation. Not one single brewery out of those interviewed received all of these ingredients from within the region. Rather much of the cluster's malt and hops are coming primarily from the Pacific Northwest, some from as far as Germany, depending on the make up of the product. A few breweries are able to source some of their ingredients from inside the region. A few firms are able to get their malt, yeast, or wheat from the Denver area or other parts of Colorado. However, as stated by one interviewee "sustainability is a significant effort... we have a preference to source locally, but we cannot get some of our ingredients in Colorado."

The brewery cluster in Colorado was able to thrive because of one key element: access to water. Porter (1990) asserts that access to raw materials does not lead to a competitive advantage because any company can access it. Conversely, they are still vital to cluster formation. Through a cross case analysis of all interviews, one major theme stood out the most: initial cluster formation of the craft beer industry in Northern Colorado can be largely attributed to the region's access to mountain headwater. All eleven breweries interviewed stressed the vital role that access to quality water played in their establishments. Several breweries cited that the water in the region was some of the finest in the county. It is first use water, straight from the snow packed mountains, and very little (if any) treatment is needed before it is ready to use in the brewing process.

According to the City of Fort Collins (2016) the area's water comes from the Colorado-Big Thompson Project, which includes Horsetooth Reservoir, and the Cache la Poudre River basin. The

Poudre River is a crucial source of water for both Fort Collins and Greeley. The Poudre river gets its water from the Western Slopes of the Rocky Mountains. Unlike many other water sources, it remains dam free. For the remaining portion of water needs, the Colorado-Big Thompson is the water source. Reservoirs from this project get their water from snowmelt. Horsetooth reservoir is major resource for the City of Fort Collins and Greeley. It serves as a terminal, off-storage reservoir for the Colorado-Big Thompson project for which it is utilized for public water supply, agricultural water supply, industrial water supply, and recreation (Hawley & Boyer, 2014). Over the past few decades the reservoir has come under scrutiny for issues with water quality related to aquatic life and drinking water treatment (Northern Colorado Water Conservancy District, 2012). Northern Colorado, as a region, has recently been dealing with issues of drought and a shifting water supply (Kyle, 2014).

Water was undoubtedly one of the primary factors that led to the craft beer cluster formation. However, in light of recent water issues, its relevance in a sustained competitive advantage has come into question. The highest concentration of craft breweries is in the Fort Collins metro area, a portion of the cluster that continues to grow rapidly. If this portion can continue to thrive even in lieu of recent water issues, perhaps Porter (1990) was correct in his assessment of clusters and their ability to achieve a competitive advantage. Though factors of land play a role in initial cluster formation, they are not believed to give a region a competitive edge over another region.

Data gathered from the interviews indicate that the geographic scale of importance for this raw resource is the broader multi-region area or the county. Water is a factor that is significant to more than just the local community. It is either serving the entire metropolitan area or multiple counties. Interviewees were persistent in tying water quality to the broader region –or all of Northern Colorado and Metro Denver. Many of the interviewees specifically stated that Northern Colorado and Denver has some of the finest water in the nation. With this, however, different areas of the cluster have different water sources. Larimer County has a different water source than Boulder County. As Boulder receives its water supply from Silver Lake and Lakewood reservoirs on North Boulder Creek; Barker Reservoir on Middle Boulder Creek; and Boulder Reservoir, Fort Collins water supply comes from the Colorado Big-Thompson Project and the Cache La Poudre River (Boulder, 2016; Fort Collins, 2016). Although water originates from the snow packed mountains, having separate water supply storage or sources can affect the quality of one municipality's water but not the other.

Unskilled Labor: Unskilled Labor is said to not lead to a competitive advantage; however it is still part of cluster formation (Porter, 1990). It was assessed in this case of the craft beer industry to verify this claim. All eleven breweries interviewed stated that their employees, in terms of those who did not hold some form of specialized education or trade, were local. In the case of Fort Collins, many of the breweries cited the fact that residents of the city itself were able to meet this demand. Though it is said not to lead to a competitive advantage, having access to non-specialized labor still has an advantage according to interview subjects. One interviewee said, “We have a college workforce that can sling beer.” Another stated that, the industry is still very competitive, and many people in the area look to be a part of it, even if they are over qualified, because it is a lifestyle.

Unskilled labor seems to operate at a different geographical scale according to the interviews. The themes here shifted from a region search, where specialized workers were often sought from adjacent cities or counties, to a more localized search, where non-specialized employees could be found in the community. Whether or not having access to a sufficient amount of labor inside the community itself leads to a direct competitive is still unknown, however, in the case of the craft beer industry, the breweries pride themselves on providing jobs for the locals.

Local demand conditions are necessary

While speaking with the owners, co-owners, CEOs, managers, and brewmasters of Colorado breweries, one thing became apparent: local demographics play a large role in both the formation of the cluster and its continued success. Expressly stated throughout cluster theories, the community plays a vital role in supporting a given industry through consumption. There are several qualities that Porter (1990) claims aid in creating and sustaining a competitive advantage. Sophisticated and demanding buyers are a key trait. Cultural and physical proximity allows a firm to assess needs. This will shape the firms’ priorities. A number of other key factors play a role in local demand. This includes the size of the population, its growth, and how early the firm penetrated the market. With a demanding customer base, firms in a cluster are pressured to compete more effectively through innovation and quality. As put by one interviewee in Fort Collins, “if it weren’t for the local demographics, the industry wouldn’t be successful.”

Customer Base: The first step of this process was to assess the area to see if locals or tourists are supporting these breweries. Interviewees were asked who makes up their customer base, and if they relied on tourists from out of the area or locals. Additionally, they were asked if they export

their product to other regions around the country. The answer to this question is twofold. First, locals, though not always the majority of the customer base, play a large role in supporting these breweries. Ten out of eleven breweries stated that locals are at least half of their customer base, with three stating that locals were the majority. Second, even though beer tourism is a major component to this cluster, it does not carry as much weight as the local consumer does. Beer tourism has gained great momentum over the last decade, with many news articles expressing the uniqueness of this activity. People are willing to travel from across the nation in order to try out the craft beer in a given location. According to one interviewee “people are planning their vacations around craft beer.” Even so, breweries in Fort Collins and surrounding regions affirm that having a strong local base is vital to cluster formation. Seven out of eleven breweries stated that a portion of their customer base is tourist, with only one stating that tourists are the majority.

Demographics: Competing on taps and shelves is another unique characteristic of this industry. Given the opportunity to compete on multiple levels of geography might sway breweries to look past local needs and focus on a larger market. Conversely, this aspect did not seem to play a major role with many of these breweries. Only a few, mainly larger breweries, distribute their product to other states. Several of the interviewees claimed that taproom business was their main line of business. People in the area want to come and hang out. One respondent even noted the importance of having an outdoor porch space for customers, alongside indoor taverns to accommodate patrons during all times of the year. Another told a story about how they tried to export product to a few other states but felt it was advantageous to focus on local consumers, so they quickly ceased out of state sales. Several of the breweries were relatively new to the business, stating that they hope to one-day export to other states. This was, of course, contingent upon their growth and success within the cluster.

Sophisticated and Demanding Buyers: One of the fundamental concepts supporting local demand conditions is that local consumers are sophisticated and demanding –a notion that was highly supported during the interviews with brewery employees. Interviews were opened with a very general question regarding the important factors of the industry. Unprovoked by a specific topic, eight out of eleven firms freely spoke about the importance of having a community that was well educated in craft beer. Coinciding with this, these firms spoke about the early brewing pioneers such as New Belgium and Odell coming into the area and educating the public about beer. One brewery stated, “twenty-two years ago they started trying to educate people about beer... this was helpful.

We are a rising tide now.” One interviewee stated that the area has an immense beer following and that many people move to Fort Collins to be part of the industry.

Much of the conversation was geared towards early pioneers that paved the way for the brewing industry. To newer breweries, it meant that the culture had been implanted for a while, so they merely had to join in on the trend. According to one brewery owner, “I believe that Fort Collins was ahead of the craft beer boom that is happening throughout the county because of larger local breweries like Odell and New Belgium. Both of these companies, New Belgium especially, have been expanding their distribution further out for many years with a lot of marketing, not just for their own brewery but for Fort Collins as well. Fort Collins has long had a fair number of breweries and educated beer drinkers, so when new breweries started opening, the population was already ready for more craft beer.”

Having a supportive community and demographic base goes hand in hand with having a customer base that is well educated and demanding. Together these ingredients are impetus for the beer industry in Northern Colorado, creating what has been referred to as beer culture. All of the breweries interviewed stressed the importance of local demographics. Not only did the interviews talk about the importance of people being well educated about beer, they went on to describe what they believe are the most supportive qualities. The common qualities that were presented throughout the interviews (regardless of location) were that the people in the area are “like-minded” in the sense that they are outgoing, active, progressive, and willing to try new things. These qualities are highly valued by craft breweries in the area.

It is important to note that despite the differences in demographics from city to city, the interviewees focused on having a diverse population—which may attest to the larger-scale, multi-county region level of geography to which this locational factor is operating. A common theme found through the interviews exemplified the importance of being in an area that held a diverse range of ages and backgrounds. All that seemed to matter was that the customer base was educated in beer, had a high level of disposable income, and was “like minded” in that they held similar values towards beer appreciation and supporting smaller, local breweries. One employee furthered this notion by stating that specific traits like age and gender do not single-handedly determine a beer enthusiast. The area has people from all walks of life, and that is most important. For the city of Fort Collins, all seven interviewees spoke of the importance of the local university, stating that having those of college age played a vital role in the industries success. However, they said that having that asset was not the main ingredient for success. As one respondent put it, “craft beer

created a culture where no one is left out... it is inclusive.” One owner stated that the beer culture was different in small towns, but still, he stressed the importance of having a diverse range of age and being educated about beer.

Culture. The beer culture stretches throughout the entire cluster, spanning from Denver to Fort Collins. It encompasses the entire region classified by the beverage production cluster (Denver Metro EDC, 2015). Certain demographics play a role in cluster development, but specific traits such as age and gender do not seem to affect the craft beer cluster particularly. The breweries in this cluster do not solely rely on community demographics; rather, they rely on the “beer culture” that has been created throughout the entire region. The traits that do affect this cluster, such as income and education, are adhered to the broader area.

Table 6.2. Income and Poverty Levels

Income & Poverty	Larimer County	Boulder County	Denver County	Colorado	United States
Median Household Income	\$53,775	\$69,407	\$51,800	\$59,448	\$53,482
Per Capita Income	\$28,921	\$38,524	\$34,423	\$31,674	\$28,555
Persons in Poverty	15.9%	13.3%	15.9%	12.0%	14.8%

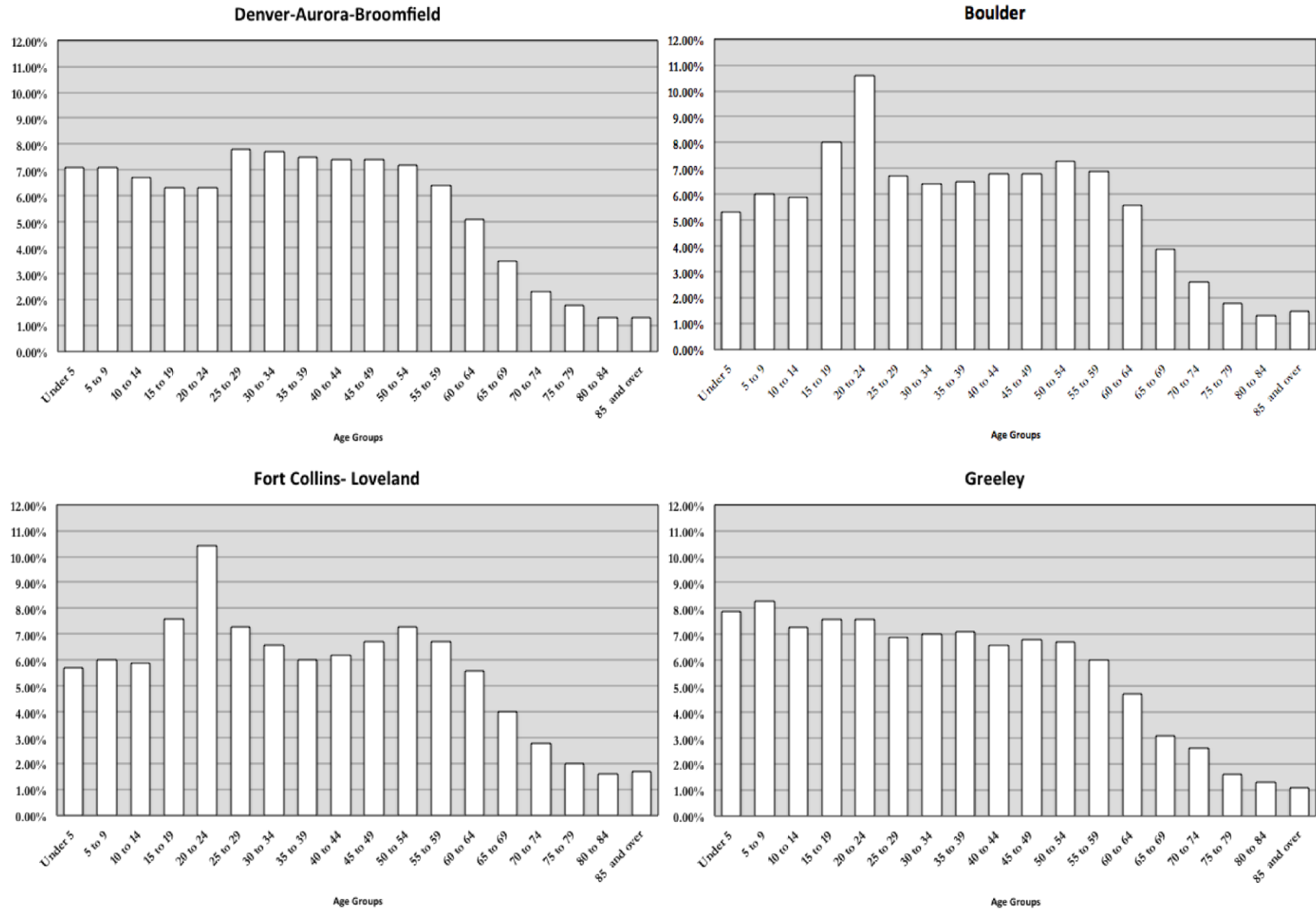
Source: U.S. Census Bureau. 2010-2014. Quickfacts.

One of the major claims made by several interviewees was that the residents in the area had a high level of disposal income –a trait that allowed them to splurge on the frills of craft beer, ultimately allowing the industry to thrive. As illustrated in table 6.2, major counties in the broader cluster geographic area have a relatively similar average median household income and per capita income as compared to the state of Colorado and the United States. Boulder is marginally higher in terms of both categories. Larimer County is lower in both categories –as is the case with Denver County. If taken as a whole, however, residents in the broader defined eleven county region have somewhat higher levels than the U.S. as a whole.

Interviewees stressed the importance of the region having a populace with a diverse range of ages. According to American Community Survey 2010-2014 5-year estimates, the region has a high population of residents of legal drinking age: 21 and older (Figure 6.1). Age groups are relatively similar across the different metropolitan areas. No single region in the cluster area has a significantly different age composition. The median age in all four metro areas is low to mid thirties. This may

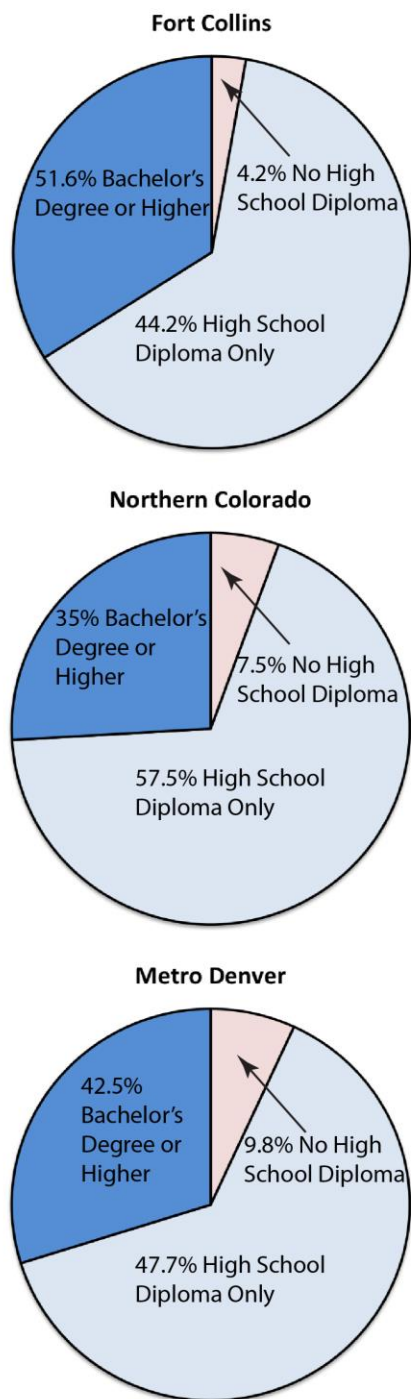
signify that demographics in the broader scope, nine county area is supportive of the craft beer industry, rather than just a single or region.

Figure 6.1. Age Groups by Metro Area



Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-year estimates

Figure 6.2. Educational Attainment by Region



Statewide, 90.2% of Colorado residents aged 25 years or older have attained a high school Diploma or higher. With this, 38.3% have attained a bachelor's degree or higher. Nationally, these percentages drop to 86.9% and 30.1%, respectively (ACS, 2015).

According, to the interviews, breweries in the region highly value the local demographics, noting that the area was comprised of a well-educated population with high disposal incomes that allowed them to partake in the beer culture.

In regards to education (figure 6.2), Fort Collins has a higher percentage of people who have attained a high school diploma and those who have attained a bachelor's degree or higher when compared to the state or the country. Education levels drop when viewed at larger geographic scales. Northern Colorado and the Metro Denver area both have levels of education similar to the U.S. as a whole. If combined with all counties, the nine county cluster area defined by the Denver Metro Economic Development Corporation yields a higher percentage of residents that have attained a bachelor's degree or higher than the U.S as a whole.

Source: U.S. Census Bureau, American Community Survey, 2015

Supporting firms must be located within the region

After conducting a cross-case analysis of all eleven completed interviews, I uncovered a major theme: local supporting firms play a vital role in sustaining the craft beer cluster's competitive advantage. Influence from related businesses continues to strengthen the cluster, increasing innovation and supporting a continuous flow of ideas and information. Players in the cluster are working together, with each other, with local universities, with their suppliers, and with the community. It can be seen through the various partnerships, networks, and organizations (both formal and informal) in which many of the breweries partake.

Organizations, Networks, and Partnerships: The first step to assessing this component was to identify if the cluster's breweries were part of any partnership, organization, or network. The purpose of the group was not explicitly asked, leaving it open to the interviewee to speak openly and identify all connections locally, regionally, and nationally. Whether it was an organization for craft breweries or a group for another purpose was not of utmost importance. The group was deemed important if it could potentially strengthen the business and the cluster. In addition, they were asked how they work together with the local competition in their city as well as in the broader nine county region. Subsequently, I asked where various aspects of their business take place in order to further explore the significance of geography. And finally, I asked them to assess the area in terms of supporting businesses and industries such as financial institutions, law firms, technology firms, and management firms.

When asked about regional partnerships, organizations, or networks, eight of the eleven breweries interviewed indicated that they partake in some form of regional group related to craft beer. These groups included trade organizations, brewery associations, local partnerships with other breweries or institutions, brewery chemist associations, or community groups. Many of the interviewees indicated that they were involved in several regional groups. Though majority of the groups were formal, a few firms spoke of partaking in informal collaborations. In the case of one Fort Collins brewery, the interviewee noted that, "not one employee in our organization is not involved in at least on group... collaboration raises all boats." As a member of the Colorado Brewers Guild, and a member of several other brewery organizations, this interviewee stressed the critical role that cooperation and information sharing plays in the craft beer industry.

Some examples of larger state and national groups included the Colorado Brewers Guild, Association of Brewing Chemist, and Masters Brewers Association of America. A few of the interviewees commented about the helpfulness of these larger groups in terms of gaining knowledge

of new craft beer recipes and learning new innovative techniques for the brewery manufacturing process, such as new technologies and new sustainable methods. Many of the interviewees mentioned that their brewery is a member of at least one of these larger organizations.

One of the more local groups mentioned by several breweries is composed of breweries only in Fort Collins. It is known as the Loose Affiliation of Fort Collins Breweries or LAFCB. The Director of Operations of one Fort Collins brewery spoke of some of the advantages of this local partnership, stating, “if we are out of grains, we can hit them up,” showing the collaboration between firms in Fort Collins. Other local groups included the BreWater group, a group aimed at making more beer with less water. A co-owner of a Fort Collins brewery mentioned that he is part of the CSU committee, a committee that several other brewers in the area are members of as well.

Brewery related groups were available at all regional scales, from the national level to the community level. The significance of the group in terms of the quality of information provided and their influence to innovation was not determined during interviews. Thus the significance of geographic proximity is inconclusive. It may be worthwhile to mention that, while craft brew networks were available across the nation, local groups (or connections established with nearby firms and institutions) were emphasized during interviews. Many interviewees spoke of the importance of connecting with the local university or with community groups.

Related Firms: When speaking to breweries about supporting firms, one of the founders of a Fort Collins brewery stated, “Other breweries here have very positive effect on our business... As well as the number of breweries here, there are support companies with expertise in brewery operations: boiler repair, glycol chiller expertise, welders familiar with needs of brewing applications, construction firms that specialize in breweries, ditto electricians who are familiar with automated brewing controls, etc.” I identified the theme in a cross-case analysis of all interviews. Seven of eleven firms interviewed stated that they work, in some way, shape or form, with one or more breweries in the area.

Information and resource sharing between related firms was the major activity discussed by interviewees. Information sharing is occurring on many different levels in the craft beer industry in Northern Colorado. Breweries are sharing information about new technologies in the industry, both for the production process and the business aspect of craft beer. New sustainable methods of production are also being passed through the cluster. As an energy and resource intensive industry, firms are constantly trying to utilize new technologies in order to minimize their demands on the

environment. With this, information about ingredients was also discussed. Breweries in the cluster are open about sharing new, unique ingredients with one another. Raw ingredients are being shared both to meet supply needs and to assist in the creation of new innovative products. If one brewery is running low on a given ingredient, they have no issue turning to the local competition for help.

Several of the breweries spoke highly of their competition, with one brewery industry stating that it is a very “cordial relationship between breweries.” As noted by one co-owner of a Fort Collins brewery “we push, aid and share in all aspects.” Many of the firms stated that larger firms like New Belgium and Odell are industry leaders—a notion that was backed up by Odell and New Belgium. The president of a brewing company in Fort Collins commented that New Belgium is a tech leader and even though they are not operating on the same scale, New Belgium is a good influence. Many of the local breweries look to New Belgium for help with their production process. He went on to mention that many of the breweries in the area share information and raw ingredients and that only a few breweries are not part of this group.

During one interview, the head brewmaster of a major brewery happened to mention that he had just gotten back from looking at some new equipment at Oskar Blues. Technology sharing was not occurring on the same level as other forms of information, however. Only six of the ten firms stated that regional competition influenced their use of technology. One firm stated that firms out of the region influence their technology. Odell and New Belgium, being leaders of the industry, spoke about how they readily share information with other firms, but in terms of influence, they push themselves to be more sustainable.

Geographic proximity plays a major role in this aspect of industry clusters. As the interviews highlight, breweries seem more incline to help related breweries within the same vicinity, which in this case, was often the city or county. Firms in Fort Collins focus on sharing information with breweries in the area around them. The same went for the breweries in Greeley, Berthoud, and Boulder, as they seemed to be more connected with nearby breweries as well. Tying this into one of the earlier questions, firms are more influenced by local competition. When all eleven firms affirmed that the presence of other breweries in the region affects their operation, their discussion was aimed at other breweries within the same city or county rather than the larger region that the cluster was defined.

Supporting Industries: All eleven breweries interviewed stated that business needs were met in the local community. Breweries said that their respective communities offered the essential services needed to support and supplement their business. This included the needed financial institutions, legal entities, and related industries such as business operations support (such as marketing, management, and logistics), technology firms, and related industries (such as glass production, bottling companies, and merchandise).

When asked where various processes of manufacturing take place, in order to validate the claims that the area had sufficient access to supporting firms, it appeared that, very seldom, did firms have to outsource activities to other regions. All eleven breweries stated that the majority of company operation occurred in house, and in the region. Two of the breweries had marketing done by firms in another state, but in both cases that marketing company had shifted operations out of Denver, and the brewery found it more convenient to stick with the same company. Canning and bottling of beer also occurred out of the region for several of the breweries, and the materials used came from other states.

The geographic scale significant to this aspect of supporting firms seems to be geared more towards smaller scale proximity similar to the other aspects of supporting and related firms. All eleven breweries confirmed that all supporting firms and industries were available in their city. Just as Porter (1990) asserts, the availability and influence of supporting firms is crucial to this mass of breweries. However, as these interviews suggest, proximity may deviate from one or more of the geographic definitions of the cluster. The interviewees suggested that supporting firms were more significant when located locally within the city rather than in a different county.

Influence to firm strategy, structure, and rivalry is driven by related firms only within the region

As one of the four points of Porter's diamond, firm strategy, structure, and rivalry claims that local conditions affect firm strategy and structure. In addition to this, local rivalry is believed to be beneficial to a cluster's level of competitiveness due to its ability to exert pressure on firms to innovate and improve. First, though competition seems to be a major influence for firms in the region in terms of innovation and cooperation, less than half of the firms indicated that other local breweries influenced their company's strategy or structure.

Second, breweries in the area feel that the connection within the cluster is positive; however, a vast majority of the breweries feel competitive with firms, not in the defined cluster region, but

more locally –indicating that competition in this cluster may be operating at a different geographic level. Tourism is a major component of the industry’s customer base. When tourists come to the city, however, they often only select a few breweries to visit due to time and other resource constraints. Breweries located in the same the city (especially when located on the same block) must compete for tourists.

Rivalry: One aspect of this locational determinant is local rivalry—a driving force that pushes firms within a cluster to move beyond basic advantages, causing them push innovation and quality. All eleven breweries indicated that there is a positive effect from breweries in the area that consists of working together in a cooperative fashion. For seven of these breweries, this included a form of healthy competition that they feel push them to create more innovative, original products. One interviewee stated, “there is definitely a strong synergy in the critical mass of breweries... firms are cooperative.” Several of the firms went into detail about how they share information with one another, educating each other with new manufacturing innovations or even ingredient profiles. Another interviewee stated that, “the craft beer industry is based off of creativity and being unique.” For this, they are constantly assessing the environment to see what other breweries are doing.

Another major theme uncovered while assessing the dynamics of local competition in the craft beer industry was the opportunity it provided for breweries—the opportunity to exploit the region’s propensity to draw in tourists. Several of the firms said that the competition made it possible to even do business in their city. Without the agglomeration of breweries, a vital support system of the cluster would not exist –the existence of beer tourism. Eight of the companies interviewed, though their customer base may be majority local, benefit, in some fashion, from the tourist drawn in to the region.

Firm Structure and Strategy: The breweries in the area have a diverse range of business structures, ranging from large companies based on hierarchy systems, to smaller, family owned and operated breweries. With this, the notion of local firms influencing business structure may be contingent on factors other than regional ventures. Only four out of eleven of the breweries interviewed felt that local breweries influenced their company in terms of structure or management. The remaining stated that their business structure was not influenced by the local business environment, but rather it was shaped more so by either unique ideas or traditional systems.

One of the largest breweries in Fort Collins stated that their company philosophies came from a national network and that their company’s structure was based off of traditional business operations. As one of the longest operating and most successful breweries (based on sales) in the

region, this company has asserted themselves as trendsetters within the industry. Being a pioneer in the industry, they did not have the option to look to other regional companies for their initial business plans. But even with proven success, other, more recent startups claim that they formulated their business, not based on these industry pioneers, but based on their own ideas or plans pulled from traditional business plans.

Six of the firms explicitly stated that their respective company's strategy was shaped more by the local community than the local business environment. One interview, in particular, illustrates this concept the best. The owner of a relatively new brewery in Fort Collins stated that his initial intention was to open a small brewery that focused on manufacturing and would only offer small tasting samples. However, because of the demands in Fort Collins, this owner felt that he had to shift to a taproom, creating a tavern to accommodate the needs and wants of the community. Speaking with the breweries, it became clear that, similar to the aforementioned case, breweries based their company on local demands rather than on the influence of competition.

After evaluating the dynamics underlying competition between breweries, it became evident that the geographic scale was different from the definition of the beverage production cluster delineated in Northern Colorado and the Denver Metro area. When speaking with breweries in the cluster, the perception of competition was limited more by local boundaries than the defined region. Nine out of eleven firms stated that their competition was with local breweries but by local, they did not mean the nine county region that included the Denver Metro Area. Rather, they found that only surrounding firms within their respective cities were their main competition (when it came to taproom operations). Albeit, for a few of the larger firms, competition extended to the shelves of chain stores as they also relied on exporting their goods across the nation. This meant that they also competed on a national level.

Other Factors

Though government was not included in the locational determinants of Porters Diamond, several interviewees stated that state laws and local regulations were a major influence for their locational decision. When asked to identify factors that they believed aided the craft beer industry's success in Colorado, five of the interviewees stated that laws and taxes played a major role for early establishments. Two of these firms are considered early pioneers in the area indicating that the regulatory environment was key in creating the cluster initially. Several of the firms also mentioned zoning regulations as a major influence in their locational decision.

One firm specifically noted that state excise tax (tax on the purchase of a good), self-distribution laws (allow brewery manufacturers to make direct sales to retailers), and a lack of franchise laws helped the initial formation of the brewery cluster. According to one interviewee: with state excise taxes, fees on beers produced are some of the lowest in the country; self distribution laws made it possible for brewery manufacturers to do direct sales; and in the 1970s, laws were made to protect beer from consolidation of smaller breweries, and in the 1990s a lack of franchise laws made it less difficult to operate a brewing business.

Chapter 6 - Conclusion

The aim of this study was to understand the role that geographic proximity plays within the four points of Porter's diamond. I used a combination of secondary data and interviews with key players to understand regional cluster dynamics in the craft beer industry cluster in the northern portion of the Front Range Urban Corridor. Several key inferences can be taken away from this case study. First, the findings support that much of the underlying concepts within Porter's outline of cluster theory carry into brewery manufacturing in Colorado, and that only a few areas of the diamond stray from theory and do not rely on physical placement. However, the situation where sub-factors within the four points of Porter's diamond do not coincide with theory may highlight that industry clusters are distinct from one another and may rely on different scales of geographic proximity. Due to this divergence, economic development policy aimed at strengthening cluster dynamics may have to be specifically tailored to address different geographic scales.

From this study we may better understand how traditional theories of cluster development carry over to the craft beer industry specifically. Proximity plays a major role in the diamond model derived by Porter (1990). Factor conditions; local demand; related and supporting firms; and firm strategy, structure, and rivalry all rely (on some level) on proximity and access. Only a few sub-factors within Porter's diamond do not rely on proximity. Some raw materials, partnerships and organizations, and influence to firm strategy and structure are taking place outside of the cluster or are not affected by regional forces. These activities do not entirely rely on physical placement for their success. Breweries in the Northern Colorado craft beer cluster are getting many of their raw materials from outside of the cluster region; they are benefitting from partnerships and organizations from around the nation; and breweries not located near them are affecting their business strategy and structure.

Other aspects of Porter's diamond do not entirely apply to this particular cluster, such as in the unique case of water being vital to the cluster's success. Water is categorized as a basic land factor, which does not theoretically lead to a sustained competitive advantage. Nonetheless, water has played a vital role in the formation of the craft beer industry. Though it has been linked to quality issues in the past few years, breweries in the region still depend on it to create a quality product. Interview subjects seemed assured of its quality and have no doubt in its contribution to the success of the brewery industry.

Michael Porter's original cluster study was based on a national scale. However, the concepts developed in "The Competitive Advantage of Nations" were later carried over to smaller geographic scales such as states and regions (Porter, 1996, 1997). Researchers have backed the importance of regions replacing nations as the engines of economic growth (Ohmae, 1995). Nonetheless, inconsistent cluster definitions regarding the precise delineations of regions may be limiting the application of economic policy to cluster development. Economic development policy relies on a rigid definition of an industry cluster based on precise cluster analysis. An issue presents itself when cluster definitions and their geographic scale vary between analyses. As such, important sectors of a cluster are often classified under various industries and multiple geographic scales. Policies aimed at clusters such as this run the risk of duplicating or wasting resources and development.

Speaking to people involved in the cluster highlighted the disconnect between theory and reality. It was found that the four points of Porter's diamond rely on different scales of proximity. In regards to competition, firms seemed to be concerned only with related firms located within the city limits. The same stood true for transportation infrastructure. Nevertheless, specialized labor and knowledge capital were more significant on a broader scale, one that may encompass multiple areas.

It was my intention to offer insight into the dynamic nature of industry clusters and to show that each industry cluster is distinct from one another. The findings from this report may emphasize the spatial disparities between industry clusters. Thus, economic development policy aimed at strengthening a cluster must place emphasis on a given cluster's distinct geographic nature. Policy makers must realize that defining a cluster strictly through quantitative analysis may put limitations on the success of a policy. For example: if the goal of a local municipality is to improve the regional workforce in order to strengthen a given cluster, knowing the most precise geographic scale that the cluster's workforce is significant at may aid the policy's success.

More research is needed to fully understand the specific geographic scale to which these locational determinants are operating. Even though the geography of clusters can be dynamic according to Porters model, a specific geographic scale may be more relevant to understanding a given locational determinant. As such, they may apply differently, with a sense of proximity meaning more or less to a given factor. If a cluster is confined to an entire region (that consists of nine counties, for example) it does not mean that the players within the cluster are utilizing or benefiting from the entire area. The local community or city may have all of the ingredients needed to formulate a successful cluster.

We currently know that the brewing industry is performing well in terms of monetary impact. Therefore, understanding what components are causing it to perform at this level may aid the improvement of similar cases. Not only will the findings this project help us to identify a framework to assess the implications of a regional industry cluster, but also, it will help us to better understand how non-traditional, more specialized industry clusters function in general. What makes a particular cluster successful in one area and not in another is of utmost importance.

The results of this study may apply to similar industries but not to all. Industry clusters may operate differently from one another, dependent on numerous factors such as the product or service being produced, the land and its unique qualities, or on bureaucratic interests specific to that area. Nonetheless, it is important to raise questions regarding the relationship between cluster determinants and geographic proximity. Public policy makers may choose to take the results of this study into account when formulating recommendations aimed at increasing the performance of firms in a given industries or increasing a region's competitive advantage.

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Appendix A - Interview Questions

Subject: Employee of Craft Brew Company in Northern Colorado

1. Locational Factors

- (a) What local factors do you believe have aided the craft beer industry's success in Northern Colorado? Are there any factors outside of the region (state or national) that you believe have aided the industry's success?
- (b) What is your perception of the region's infrastructure in terms of supporting a brewery (transportation & education)?
- (c) Does the land have any unique qualities that are supportive of a craft beer firm, such as access to water or other inputs?

2. Business environment

- (a) Who are your major competitors?
- (b) Does the presence of other breweries in the region affect your business? How? Do competitors outside of the region influence your business? How?
- (c) Does the area have sufficient access to supporting companies such as banks, insurance companies, law firms, etc. or do you have to turn to other regions for these resources?

3. Connection to the local community

- (a) Do you feel that local demographics are important to the industry's success? Does your firm benefit from the local "beer culture"?
- (b) Is your major customer base comprised mostly of local residents, or do you rely on exporting your goods to people outside of the region?
- (c) Are you a member of any partnerships/ networks with universities or other organizations in the region?

4. Production process

- (a) What aspects of your business (manufacturing, distribution, marketing, etc.) occur within the region? Are there any that take place outside of the region?

(b) Are your major suppliers local or outside of the region? (Where do you get your ingredients: yeast, hops, malt, wheat and water)?

(c) Do competitors in your region influence the level of technology you utilize in your production process? Do they push you to be more innovative with products or be more efficient/ productive in manufacturing?

5. Firm Configuration

(a) Do you feel that the business environment in Northern Colorado influences your company in terms of business strategy, company objectives, or management structure? How?

(b) Does the region provide your firm with an adequate labor force in terms of specialized workers? Where are your employees from?