CAMBRIDGE SYSTEMATICS

Transportation and Logistics Hub Study

Appendix B

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MRCOG Region Sector Competitiveness Assessment

Appendix B

prepared for

Mid-Region Council of Governments

prepared by

Cambridge Systematics, Inc.

with

GLD Partners

March 23, 2017

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report

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1.0 Competitiveness Assessment Introduction

This memorandum features an analysis of the Mid-Region Council of Government (MRCOG) region's economic competitiveness in four key industry sectors, as compared to other regions. Specifically, this report features the results of a customized competitiveness assessment model that was developed to illustrate how a corporate decision maker might initially access location-influenced site options for a real-world project example. This work was led by GLDPartners as part of the MRCOG Transportation and Logistics Hub Study.

The assessments were undertaken based upon readily available data and prevailing industry knowledge. These models benchmarked the MRCOG region against competitors for four sectors: distribution, food manufacturing, aerospace and photonics**.** These four industries help illustrate how various location factors influence location decisions, identify location strengths, and suggest areas for improvement.

Chapter 1 describes the framework of the competitiveness assessment model, data sources, and summarizes key findings. Chapters 2 through 5 each focus on an industry sector, and features relevant information including the size of the sector, location of operations, competition, and logistics issues. Within each chapter is an industry-specific scenario, which is based upon an actual US company's site location search and details their job creation requirements, investment projections, primary markets, transportation modes and competitor locations for consideration. After outlining the industry details, the results of the competitiveness assessment model are presented based on the projected success of the investment in the MRCOG region as compared to other competitive markets.

1.1 Methods and Data Sources

The framework for the competitiveness assessment model included a specific project investment scenario defined for each industry segment that is based upon a real company project. The scenarios included product mix, employment, facility size, supply chain requirements, and transport requirements. Cost comparisons for each specific model were developed from a mix of public and proprietary sources. Qualitative criteria was selected by the GLDPartners team based on interviews, research & past deal and sector experience. Relative weights were developed among the main categories and for each criterion within a category as a proportion of 100. Weights vary for each supply chain model depending upon nature of the scenario. For each model, candidate locations were scored based on quantitative factors using a 1-10 scale (with 10 being the best score). A competitive total score normally ranges between 6 and 7 and a difference of more than 0.05 is considered quite substantial.

Five broad categories of factors were used to develop each model. These are shown in Table 1.1, with additional details on data sources included in the Appendix B of this report.

Table 1.1 Competitiveness Assessment Review Factors

Transportation Costs	Time in Transit	Business Reliability	Facility Availability and Operating Costs	Labor Availability and Costs
• Point to point shipping costs of finished product	• Time in transit for finished product to market	• Labor union participation rates • Freight route security • Freight delays caused by weather • Trucking delays caused by congestion • Late pick-up time for integrators • Highway impediments	• Industrial building lease rates • Costs for fully serviced industrial land • Cost of electricity • Cost of gas • Total tax burden • Certified site program	• Unemployment rate • Worker availability within 45 minutes • Technical training for workers • University degrees for electrical engineers • Average hourly salary for sector employees • Centers of excellence/ business relationships • Direct international commercial flights outside of North America

1.2 Summary Findings

After a thorough review of the four selected industries, their supply chains and the Albuquerque region's competitiveness, it is possible that the region can compete for certain projects within these industry groups. The region can increase its success rate by understanding the areas where it competes best (its sweet-spot markets**)** and creating highly detailed business propositioning to specific sector audiences. The results of the Competitiveness Modelling are a direct output of project scenario specifics which are based upon real-life distribution and manufacturing business operations.

Most importantly, for the Albuquerque region to "make the cut" for initial site selection analyses, it will be necessary to demonstrate that it can provide an overall supply chain management advantage, including:

- **Better overall total landed cost,**
- **Higher or very competitive levels of reliability, and**
- **At least competitive delivery times.**

This does not suggest that the region will compete for the majority of projects in these industries. From a supply chain perspective, the region's location is largely a challenge as compared to likely competition but if the region focuses on specific niches that will find strategic value in a central location (i.e. between Texas and California), it could be seen as a realistic competitor. The region can succeed if it is able to present the prospective investor with sector-focused facts and a comprehensive business proposition. Albuquerque will need to define its ability to compete on the basis of transport connectivity, trained and ready access to specialty labor, a highly developed value-add from industry and research collaboration, physical asset development and overall cost. In these cases, the Albuquerque region can be regarded as a serious and legitimate competitor.

In the course of conducting the Competitiveness Analysis, several observations were made that are important to note.

- The Albuquerque “product” doesn’t necessarily sell itself to many categories of investment.
- The region should become more precise and aggressive in its business development activities and policy development. Progress has been made in improving the State business climate, and these actions clearly make New Mexico more competitive.
- A more targeted strategy must be pursued by specific industry sector that considers supply chain advantages offered by an Albuquerque location.
- Labor skills and supply are relatively adequate for the sectors considered, however, focus is needed to expand the size of the trained workforce by each sector.
    - Education and workforce training in the region is good and is likely an advantage, and should be customized to meet specific company requirements.
- Developed building/property asset supply is adequate for some of small-medium sized deals. However, high-specification property capital investment of scale in the urban ring would provide market recognition. Advantage would be gained by having a national-recognized investor/partner.
- Airport and Airport-centric property assets will be necessary for the region and the State to be competitive in attracting tech-oriented investment that has high-velocity requirements. As success occurs, this will allow the Airport better able to compete for additional cargo services. .
- Rail connectivity wasn’t a central factor to the modelled project scenarios by client direction, but would be important to energy, ag/bulk and manifest cargo movement requirements. Public leadership in determining enhanced rail infrastructure is quite critical.
- Clear and specific business propositions are needed in order to make a strong business case to key sector audiences.

An overview of each sector (distribution, food manufacturing, aerospace, and photonics) is provided followed by scenarios which outline the requirements for real company investment projects in each sector. Each scenario outlines specific requirements typical to most site selection project evaluations. The ability to meet these requirements were assessed for the Albuquerque region and for likely competitor regions in the United States. The Competitiveness Dashboard that follows is an output summary of the data tabulations that rate each region for the various evaluation elements. Appendix B contains the actual models for each sector.

2.0 Distribution Sector Overview

Physical distribution involves a spectrum of activities involved in the movement of goods from points of production to final points of sale and consumption. Physical distribution is comprised of the functions of movement & handling of goods, specifically transportation services (trucking, freight rail, air freight, inland waterways, marine shipping, and pipelines) and transshipment and warehousing services (consignment, storage, inventory management). Distribution activities are classified in under NAICS 493100 - Warehousing and Storage.

Distribution centers (DCs) are the main facilities from which most logistics are coordinated and these assets include a facility or a group of facilities that perform consolidation, warehousing, packaging, decomposition and other functions linked with handling freight. Their main purpose is to provide value-added services to freight, which is generally stored for relatively shorts periods of time. DCs are often in proximity to major transport routes or terminals.

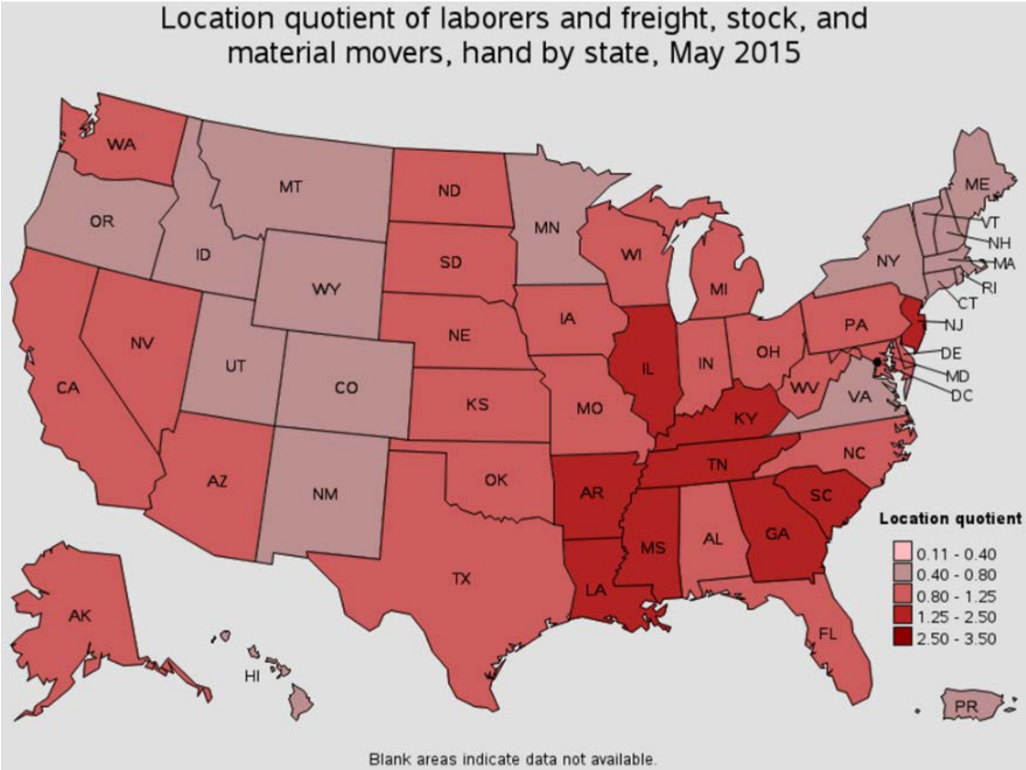
DCs or their variations can also perform light manufacturing activities such as assembly, kitting, labeling or packaging. In contrast, a warehouse is a facility designed to store goods for longer periods of time. Distribution centers tends to focus on the demand requirements while a warehouse is generally driven by supply considerations.

2.1 Sector Size

The US logistics and transportation industry combined equals $1.5 trillion of economic activity and represents over 8 percent of annual gross domestic product (GDP). Overall 4.5 million people are employed in transport and logistics, while in New Mexico, there is a lower level of jobs in distribution and related transport activities.

There are a variety of company structures that comprise the distribution sector. Distribution operations serve both retail and wholesale supply chain support functions. Many DCs are operated directly by or for retailers (or wholesalers), while others are operated by outsourced logistics firms. These third-party firms will generally operate facilities and in some cases, they will also perform other logistics functions such as transportation planning, transport carriage and as mentioned above, some manufacturing functions.

Figure 2.1 Distribution Sector Location Quotient, by State



Source: BLS, May 2015

In New Mexico skills in the Distribution Sector has a location quotient of 0.63, which suggests the State has lower industry presence than would be expected for its population size.

2.2 Industry Outlook and Competition

Increasingly, distribution operations are being outsourced to third-party logistics management firms. This trend is significant, with 3PL outsourcing growing by up to 20 percent annually (depending on specific area). Many retailers and manufacturers have found that logistics and inventory management is outside of their core competency and they have integrated purchasing and production management with outside firms that handle transportation and inventory.

Globally and especially over the past three years there has been a trend for third-party logistics firms to purchase or merge with other third party logistics firms. These transactions have allowed firms to grow in size and geographic coverage. These combinations have also provided substantial levels of synergy and efficiency that are allowing some of these larger outsourced logistics firms to provide services beyond their historic core service offerings. It is increasingly likely that many of the global 3PL companies will offer a range of value-add services to their clients.

2.3 Logistical and Supply Chain Issues

By definition, distribution centers are a critical component of the national logistics apparatus. With that, DCs play very different kinds of roles. Some DCs serve small radius catchment areas, while other DCs serve wider regional markets. Most distribution centers in the US are served by motor carriers for both inbound and outbound movements and because of this most DCs locate in close proximity to major highways.

Due to a range of issues, the distribution sector has changed and is continuing to evolve quite rapidly. The following factors are some of the key issues driving the future of distribution in the US:

- **Large vessels calling on fewer seaports** – Increasingly trans-oceanic maritime transport is fueled by larger container ships and the newest generation of mega-vessels are calling on only the major load center seaports. This dynamic has implications for distribution as cargo is being unloaded in larger “batches” and needing transport to market regions.

- **Ecommerce** – Has changed the underlying fabric of the nation’s distribution network and has fueled the majority of new DC construction in recent years. The rapid evolution in the business-to-consumer (B2C) ecommerce business model is causing more and smaller facilities closer to consumption markets.

- **Nearshoring manufacturing to Mexico** – At the expense of imports from China, Mexico has become an increasing manufacturing power. This fundamentally is changing the flow of raw inputs and finished product outputs. Due to this dynamic, logistics patterns have incrementally shifted from heavy import loads on the West Coast at a few seaports to increasing north-south traffic along the US-Mexico border.

- **Reliability challenges** – A range of extraordinary events have caused structural shifts in the overall logistics system and this is effecting the distribution sector quite significantly. Labor strikes and disruptions at major seaports caused companies to revise their logistics planning – and therefore their domestic supply chain/distribution points.

2.4 Regional Distribution Center for Food Industry Redistributor Scenario

Background: A food industry redistributor that buys full truckloads of product from 830 manufacturers and consolidates those products in 9 distribution centers located across the country. Their strategy is to add several new centers in strategic locations where their operations have been less efficient. The company then resells products in less-than-truckload (LTL) quantities to distributors on a weekly basis. The company owns and operates its own truck fleet. Would serve portions of 5 states.

Project: $45 million investment to include a combination of facilities under one roof totaling 163,000 SF including refrigerated, frozen and dry storage space, office as well as a 9,700 SF truck garage.

Development proposition: Build-to-suit

Jobs: 125 warehouse and distribution workers

Raw materials sourced: From across the US

Markets served: Southern California, Southern Nevada, AZ, NM, and UT

Modes used: Truck

ABQ Competition: Kingman, Arizona, Amarillo, Texas, and Bakersfield, California

Table 2.1 Regional Distribution Site Decision Factors

Regional Distribution Site Decision Factors	Albuquerque, NM	Kingman, AZ	Amarillo, TX	Bakersfield, CA
Transport Costs	1.69	2.13	1.25	1.94
Time in Transit	0.68	1.24	0.38	0.94
Reliability	0.99	1.14	1.04	0.79
Facility Availability and Operating Costs	1.08	0.63	0.99	1.04
Total Tax Burden	1.00	0.60	0.80	0.40
Labor Availability and Costs	1.32	1.12	0.92	1.72
Competitiveness Score	**6.75**	**6.85**	**5.38**	**6.82**

Caveat: This is a real-life simulation of an actual investment project that demonstrated specific requirements that were unique to that company's business situation. No two investment projects are alike, but we can learn from this in reviewing how Albuquerque would have fared if considered a viable competitor.

How to Interpret the Results Table

This is an objective numeric assessment of the key factors involved in a location decision process. There is little or no subjective input in evaluating the scoring results.

Decision-makers will undertake their review of the Overall Competitiveness Analysis by first evaluating the overall score.

- Scores are based on a 0-10 scale, with 10 being the highest.
- Scores that are within .10 of each other should be considered statistically equal
- Scores that are within .25 of each other should be considered as close competitors
- Scores that are more than .25 of each other should be considered meaningfully different
- Even in the case of a high or competitive score, decision-makers will want to review areas of distinct weakness in an overall score as this can be a significant variable when making a final decision among close competitors
- Scores are already weighted to indicate relative importance of factors as they relate to each other – so the Overall Competitiveness Score should be a meaningful indication of the best choices.

2.5 Conclusions

In this example, given the relatively close overall scoring, Albuquerque would be seen as a serious competitor to win this investment. But with closer examination, it is important to disaggregate the factors to understand the region's strengths and weaknesses. Again the specifics of the modelled example tell us that the region won't compete well on its location for supply chain end-points where there are better situated regions. So, as connected to the seaports in Los Angeles or the Southern California consumption market, places like Bakersfield or Kingman are physically closer which reflects in transport time and transport cost scores. However, in the areas of operating costs, labor availability and tax burden, Albuquerque performs very well. So, in the aggregate the region fares well and would be seen as a competitor for this project by relying on its relatively large metro area size, labor availability and low taxes. What we can further surmise is that the region would perform even better for specific supply chain lanes – where its location might be considered more strategic.

3.0 Food Manufacturing Sector Overview

The food sector from food production through food service and retail remains one of the largest sectors of the economy and one that has continued to grow and create new jobs even through the Great Recession. Industries in the Food Manufacturing subsector transform livestock and agricultural products into products for intermediate or final consumption. The industry groups are distinguished by the raw materials (generally of animal or vegetable origin) processed into food products. The food products manufactured in these establishments are typically sold to wholesalers or retailers for distribution to consumers, but establishments primarily engaged in retailing bakery and candy products made on the premises not for immediate consumption are included.

The food manufacturing subsector consists of these industry groups:

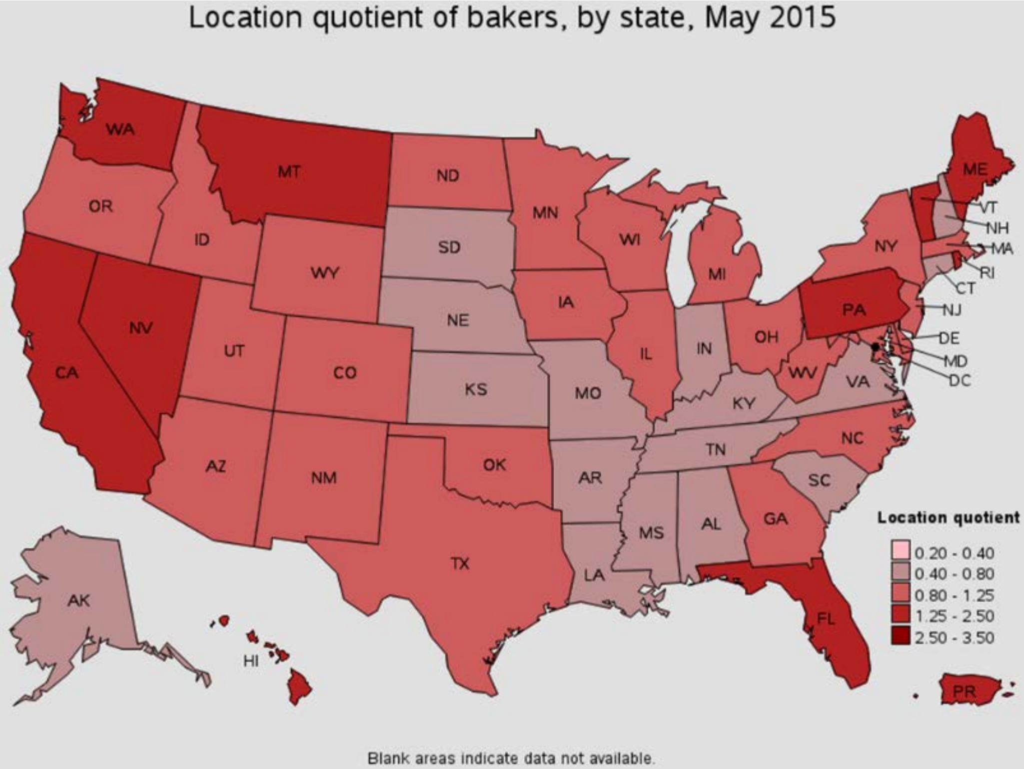
- Animal Food Manufacturing: NAICS 3111
- Grain and Oilseed Milling: NAICS 3112
- Sugar and Confectionery Product Manufacturing: NAICS 3113
- Fruit and Vegetable Preserving and Specialty Food Manufacturing: NAICS 3114
- Dairy Product Manufacturing: NAICS 3115
- Animal Slaughtering and Processing: NAICS 3116
- Seafood Product Preparation and Packaging: NAICS 3117
- Bakeries and Tortilla Manufacturing: NAICS 3118
- Other Food Manufacturing: NAICS 3119

3.1 Sector Size

The food manufacturing / processing industry is the 3rd largest U.S. manufacturing sector, accounting for more than 14 percent of all manufacturing shipments. Currently the industry employs more than 1.4 million people working in over 26,000 establishments. According to the most recent comprehensive data in the 2014 Annual Survey of Manufacturers, these facilities had annual sales of approximately $791 billion. To put that in perspective, worldwide processed food sales total about $2 trillion. So, the US accounts for 37.5 percent of all sales. Other large markets include Western Europe and Asia, with China growing the fastest.

Food and beverage processing plants are located throughout the United States. But according to the most recent Census Bureau's County Business Patterns (CBP), California and Texas are the leading food and beverage manufacturing States. The industry tends to agglomerate near either a raw material base and/or market (customer) proximity. Consequently, as measured by industry employment, it is not surprising that California is the leading food processing state due to raw material base and market size. In fact, nine of the top 10 states represent both dense concentrations of raw materials and consumers within reasonable proximity (e.g., within 400-500 miles). The leading food processing states are: California, Washington, Wisconsin, Illinois, Texas, Florida, Ohio, Pennsylvania, New York, Oregon, and North Carolina

Figure 3.1 Food Manufacturing (Baker) Location Quotient, by State



Source: BLS, May 2015

In New Mexico skills in the Food Manufacturing sector has a location quotient of 1.06, which suggests the State has a slightly higher industry presence than would be expected for its population size..

3.2 Industry Outlook and Competition

Population growth is really the biggest driver of food consumption and for the most part, price is the major point of competition. Large companies control much of this industry, with 50 of them snatching more than half of all available revenue. However, small companies can effectively compete by developing popular products.

A quick list of the top commodities bought by consumers is as follows:

- Processed meat – 25% of total industry revenue
- Dairy products – 15%
- Edible oils – 9%
- Processed fruit and vegetables – 8%
- Baked goods – 5%
- Snack foods – 4%
- Pet foods – 3%

3.3 Logistical and Supply Chain Issues

The logistics issues identified in the food manufacturing sector are identified as follows:

- Truck is the primary mode of transport for food products. Dry groceries move through the normal trucking system in the US, Mexico, and Canada. Major refrigerated trucking companies and independent truck owner operators haul most of the intercity perishable products with the remainder moving on refrigerated intermodal rail and bulk refrigerated rail cars.
- Food processors have traditionally located closer to the supply source and used truck rather than rail because trucks provided faster delivery from the field to the processor. However with the increased use of refrigerated containers there is on-going placement of containers for loading at the harvesting site and then is shipped in rail intermodal (some cases - unit trains) service to warehouse/distribution centers. Some produce is loaded into box cars where spoilage is not an immediate concern, such as onions, potatoes and tomatoes that are used in the canning process, as noted because of a plant's scale Air freight is not normally used to ship either raw materials or products with the exception of high-value cargo such as certain kinds of seafood.
- The requirements for port connectivity in the past have been modest for the food manufacturing/processing industry with exception of imported ethnic foods, produce and some specialty foods like seafood. However the USDA has reported that exports of high-value processed food products have been a significant contributor to the strongest five-year period for agricultural products in history and these products typically move by ocean transport
- Two critical specialized transportation needs are refrigerated vehicles and "protect from freezing" for some foods such as dairy, fresh bakery, and many liquids in cans.
- Major retailers expect very high reliability, such as 98%+ on time and complete orders.
- Transport and distribution costs typically run 5-10% of cost of goods in this industry.
- Time in transit is wildly varying depending on the mode, customer expectations, etc. In general trucks can reach anywhere in the U.S. in 5 days and rail within 10 days, including delivery.
- A network of refrigerated warehouse storage facilities have been developed in close proximity to growing and consumption zones across the country.

3.4 Food Manufacturing Scenario

Background: A Canadian company that specializes in the manufacture of cookies and snack bars. Market is US, with exports to more than 20 countries. The company currently has over 700 employees and six modern manufacturing facilities.

Project: The company is interested in an existing 175,000 SF manufacturing building and will invest about $50MM in plant and equipment.

Development proposition: None, searching for an existing building

Jobs: 100 including food technicians

Raw materials sourced: From across North America; grain sourced by rail

Markets served: Wants a greater market presence on the US West Coast, and in Mexico and South America. The product for these markets is currently being produced in TN and the company wants to reduce transportation costs.

Modes used: Final product moved by truck

ABQ Competition: Santa Teresa, New Mexico, Las Vegas, Nevada, and Idaho Falls, Idaho

Table 3.1 Food Manufacturing Site Decision Factors

Food Manufacturing Site Decision Factors	Albuquerque, NM	Santa Teresa, NM	Las Vegas, NV	Idaho Falls, ID
Transport Costs	1.02	1.01	1.07	0.75
Time in Transit	1.02	1.01	1.06	0.76
Reliability	1.14	1.23	0.90	1.17
Facility Availability and Operating Costs	1.00	0.76	1.08	0.94
Total Tax Burden	0.40	0.40	0.20	0.50
Labor Availability and Costs	1.30	1.54	1.20	0.90
Environmental Regulations for Bakeries	0.50	0.50	0.50	0.50
Competitiveness Score	**6.36**	**6.34**	**5.82**	**5.62**

Caveat: This is a real-life simulation of an actual investment project that demonstrated specific requirements that were unique to that company's business situation. No two investment projects are alike, but we can learn from this in reviewing how Albuquerque would have fared if considered a viable competitor. [1]

[1] See page 2-9 (Distribution Profile) for instructions for interpreting the results table.

3.5 Conclusions

In this scenario the Albuquerque region would be seen as a leading competitor to win this investment. Considering the named competitor markets, the region scores the highest but is virtually tied with Santa Teresa, NM. Between the two regions, Albuquerque scores higher in property product availability and operating costs, while Santa Teresa scores well on labor costs. The other modelled regions did not perform well for this scenario for various reasons including taxes, labor availability and overall reliability. Given the western US market orientation of the scenario, logical alternatives for a project like this would be in California, but with the cost and regulatory challenges there, Albuquerque will perform well largely due to the importance of non-transportation factors. Albuquerque could position itself as a major-market food center for the large California market, and with that support a larger critical mass market base including Colorado and Northern Texas.

4.0 Aerospace Manufacturing Sector Overview

The aerospace industry is defined by The American Association of Aerospace Industries (AIA) as the industry engaged in research, development, and manufacture of aerospace systems including: manned and unmanned aircraft; missiles; spacecraft; space launch vehicles; propulsion, guidance, and control units for all of the foregoing. The industry also covers a variety of airborne and ground-based equipment essential to the test, operation, and maintenance of flight vehicles. NAICS codes 336411, 336412, and 336413 apply to this sector.

4.1 Sector Size and Products

The non-military commercial aerospace market is highly concentrated and sells mainly to airlines and leasing companies and also to owners of private businesses or pleasure craft while the government aerospace market also highly concentrated sells mainly to public defense and space exploration organizations who require product for military purposes or spacecraft for federal space programs.

Aerospace products include:

- Aircraft
- Helicopters
- Unmanned aerial vehicles
- Spacecraft
- Missiles
- Propulsion systems
- Guidance and control systems
- Communication systems
- Electronics
- Mission specific equipment
- Ground equipment

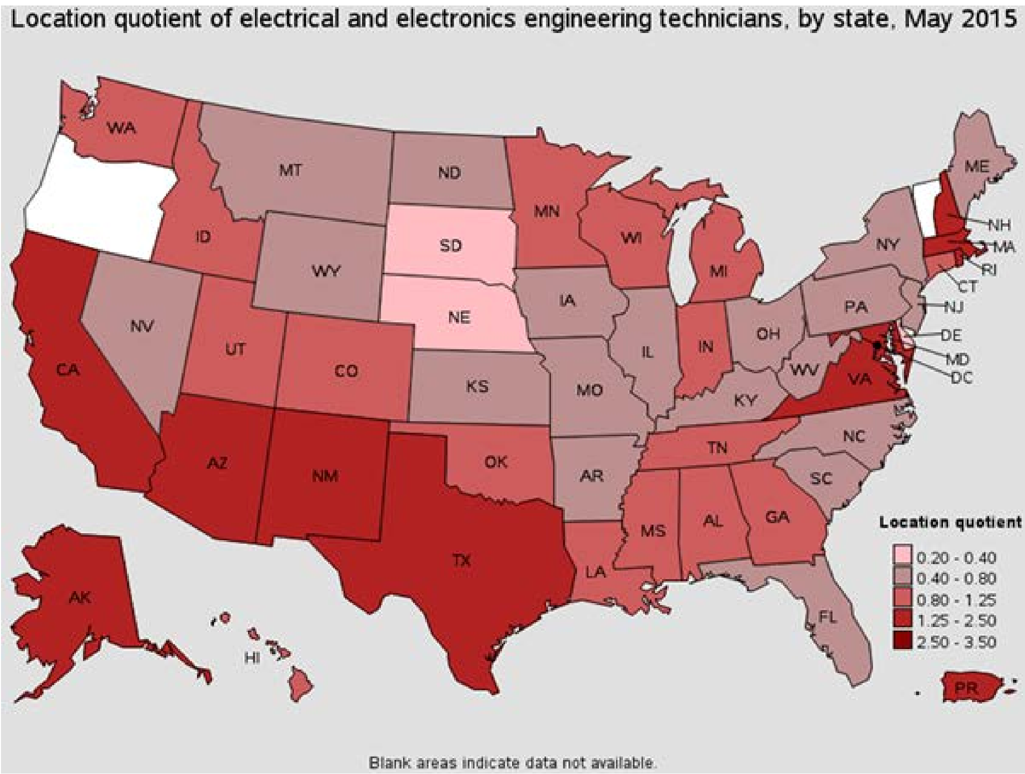
Today, aerospace is a highly concentrated industry, dominated by a small number of large firms that are supported by a large number of smaller contractors. It is also characterized as a capital intensive and high-value added industry. Profitability depends a great deal on technical expertise, innovation and the ability to accurately price long-term contracts for programs that may take years to design, develop and build.

Demand for aerospace products is driven by both civil and military requirements. On the civil aviation side, demand for air travel, and thus aircraft, is derived from the strength of the domestic economy and from foreign economies, especially those of emerging nations with a rapidly expanding middle-class. The U.S.

military budget, and to some extent, the budgets of foreign buyers of U.S. military aerospace products (both of which are based on the underlying threat of warfare), are also significant sources of demand.

The aerospace industry is essential to the national economy because it provides a significant number of high-paying, high skill jobs. It also makes a positive contribution to the U.S. trade balance. Data published by the U.S. Department of Commerce demonstrate that U.S. aerospace manufacturers are internationally competitive, accounting for the highest trade surplus of all U.S. manufacturing industries.

Figure 4.1 Electrical and Electronics Engineering Technicians Location Quotient, by State



Source: BLS, May 2015

In New Mexico skills in the Aerospace Sector has a location quotient of 2.05, which suggests the State has a significantly higher industry presence than would be expected for its population size.

4.2 Industry Outlook and Competition

Over the last five years, the global aerospace industry revenue was impacted by a decrease in the US defense budget. However during this year of 2016 we are seeing growth return through increases in the US defense budget, a resurgence of global security threats, and growth in the defense budgets of key nations around the world. In addition, relatively stable growth in global gross domestic product (GDP), lower crude oil and other commodity prices, and continued increases in passenger travel demand are contributing to expected growth in production rates for next-generation commercial aircraft.

The aerospace industry by its very nature is cyclical—with industry-specific cycles seemingly occurring approximately every 10 years—and highly susceptible to changing international situations and market forces that are often beyond its control. Commercial aircraft manufacturing sales are directly tied to the health of the airline industry, and a host of factors can influence demand for air travel, including increased economic activity, regional conflicts, terrorism, and disease outbreaks. The US represents the largest aerospace market in the world followed by France, UK, Germany and Canada.

4.3 Sector Supply Chain Issues

Global Supply Chains

The complexity of the supply chain for the aerospace industry is very complicated as it involves the coordination of hundreds of thousands of high tech and highly regulated pieces and parts to put together an aircraft. For instance the new F-35 Joint Strike Fighter aircraft has over 1300 suppliers and 40,000 individual parts. According to the Supply Chain Council of AIA, small to medium sized businesses manufacture between 70-80% of all aircraft parts. In most cases it is becoming unmanageable to have so many suppliers in the supply chain.

The industry trade associations do not see manufacturers looking for new suppliers to deal with the challenge of growth but rather the industry wants a consolidation within the industry and wants to have the Tier one suppliers get bigger and better. The number of suppliers is being cut back dramatically; the work and jobs are still there but there has to be consolidation in the supply chain.

As an example of this, in 2012 Lockheed Martin announced that they were replacing 240 vendors with just one vendor for a range of electronic components that they use in their manufacturing process. (Lockheed Martin 2012 Press Release) The vendor that was chosen is the only supplier to Lockheed Martin for 22,000 electronic components. This vendor does not manufacture these components but is the sole vendor/distributor interacting with the company.

Increased outsourcing of component subassembly requires aerospace companies to be more cognizant of not only where their suppliers are located, but how product is to be transported. How will a location choice affect the speed and reliability with which sub-assembled components can be received from suppliers, and delivered to end-user customers?

The aerospace industry's business models have changed. The era of huge aircraft factories is gone. The OEMs such Boeing, Airbus, Bombardier, Embraer, Raytheon have taken steps to ensure that they are no longer directly involved in parts manufacturing. The way in which commercial and military aircraft are designed, developed, and produced continues to undergo significant change in response to the need to cut costs and deliver products faster and this is having a dramatic impact on the supply chain.

Supply Chain Implications for Site Location Decisions

Vertical integration and co-location of activities in the domestic market, once standard operating procedure for the aerospace industry, are less desirable today. A new model of "horizontal specialization," where OEMs tightly integrate functions such as engineering, manufacturing, and customer support across multiple locations on a global basis, is growing in popularity. Boeing and Airbus as examples both currently have facilities located around the globe. Considering that the aerospace industry is one of America's few manufacturing sectors with a robust surplus in its balance of trade, and that aerospace product imports are approaching their highest levels on record, supply chain issues are more important than ever.

This goes far beyond the well-known B787 and A350 supply chain models that make extensive use of Tier I suppliers. OEMs are pursuing this more complex form of industrial organization for several reasons including enhanced productivity, leveraging the global talent pool, improving market access, upgrading value propositions, and shortening cycle times.

4.4 Logistical Issues

- Historically companies maintained at least a one month's supply of stock close to the manufacturing facility, but today because of the increased production tempo, scheduling pressures and cost containment issues less stock is held on/near-site creating a more complicated logistics system.

- Manufacturers have begun to contract with 3PLs to manage their inbound parts supply systems which has the 3PLs assuming the management of all their logistics arrangements.

- Most aircraft components are parcel size but obviously some of the components such as wings and engines are quite large. But, whenever possible larger aerospace components will move by ground, rail, or ocean carrier transportation unless there is an expedited reason to move via air cargo.

- Given the current tight production time frames that the industry is working in today, it is sometimes necessary to move the components by air freight which makes having good airline cargo connectivity, a critical site location factor.

- 3PLs are becoming an integral part of the supply chain by directly handling the logistics arrangements but also supporting the manufacturing process and handling various product movement and manipulation tasks such as staging, kitting, and other tasks. (Inbound Logistics)

- Given the on-going changes in aerospace logistics, a new economic development target company is emerging---3 PLs.

4.5 Aerospace Scenario

Background: California privately held aerospace engineering company that designs, develops and manufactures specialty custom air moving systems for the aerospace and defense industry. Interested in relocating their corporate headquarters and manufacturing operations out of California. They also have an operation in the UK

Project: Lease of a 50,000-60,000 SF existing building and will invest $7.5 million in plant and equipment

Development proposition: None, searching for an existing building

Jobs: 53 jobs will be created over a five year period and will include engineers, machinists and senior executives with an average salary of $68,000

Raw materials sourced: Various, throughout the United States

Markets served: Global

Modes used: Truck and air. Products will primarily be shipped by integrators

ABQ Competitors: Phoenix, Arizona, Wichita, Kansas, and Charleston, South Carolina

Table 4.1 Aerospace Manufacturing Site Decision Factors

Aerospace Site Decision Factors	Albuquerque, NM	Phoenix, AZ	Wichita, KS	Charleston, SC
Transport Costs	0.73	0.63	0.80	0.70
Time in Transit	0.98	0.78	1.31	1.24
Reliability	1.28	1.11	1.21	1.32
Facility Availability and Operating Costs	1.26	1.78	1.22	1.00
Labor Availability and Costs	0.98	0.96	0.96	0.72
Total Tax Burden	0.37	0.31	0.40	0.28
HQ Considerations	0.42	0.70	0.26	0.34
Competitiveness Score	**6.95**	**7.04**	**7.47**	**6.84**

Caveat: This is a real-life simulation of an actual investment project that demonstrated specific requirements that were unique to that company's business situation. No two investment projects are alike, but we can learn from this in reviewing how Albuquerque would have fared if considered a viable competitor. [2]

[2] See page 2-7 (Distribution Profile) for instructions for interpreting the results table.

4.6 Conclusions

In this scenario the competition is fierce and the final results suggest a clear winner in Wichita, but with the other competitor regions very closely ranked. The Albuquerque region might be considered a competitor if Wichita were to be eliminated for preference or a practical factor of one sort or another (such as if a property deal that were to prove unattainable, or if a new factor were to be introduced that might shift the scenario, such as a new supplier supply chain lane). Overall, the main factors that determined how the region fared were time in transit and facility availability (property). In these areas Albuquerque fared poorly versus Wichita and Phoenix, which are leading aerospace centers. In the end though, the main issue for meeting the needs of this project scenario was the region's comparatively uncompetitive position to support high-velocity supply chains to Europe. Wichita and Charleston have better air cargo connectivity and/or proximity to European centers. Albuquerque could compete better for aerospace projects that have require domestic supply chains, especially to Tier 1 suppliers and OEMs in Texas, Arizona and California.

5.0 Photonics/Optics Manufacturing Sector Overview

Photonics is the science of using and controlling photons—the smallest unit of light—to convey information and images and is one of the fastest growing high-tech industries in the world today. Electricity is the lifeblood of modern society and underlies most of our present technology. But with demand increasing electronics has nearly reached its speed limit and as the demand for faster speed increases, the need for systems based on photons or light will grow. As an example, the Rochester, New York Regional Photonics Cluster says that solid-state lighting developed through photonics research could cut electricity usage from lighting in half in the U.S. by 2030, save $30 billion and reduce emissions equivalent to 40 million cars.

5.1 Photonics/Optics Sector Size and Products

Sectors that depend on photonics include advanced manufacturing, information and communications technology (ICT), defense and national security, energy, and health and medicine. The global photonics market size is expected to reach $979.90 billion annually by 2024, according to a new report by Grand View Research, Inc.

While there are numerous accepted definitions of optics and photonics, there are no single standard definitions yet in the US. Attempting to actually define all of this, as an industry comprised of discrete NAICS codes is a very difficult task. Because the technologies are developing so rapidly and applications are multiplying and morphing so quickly, any attempt at a definition would be a moving target. Within the current industry, the terms optics, photonics, and optoelectronics are most often used simultaneously and it is an interdisciplinary field crossing Physics, Physical Chemistry, and Electrical Engineering.

Products in the industry include:

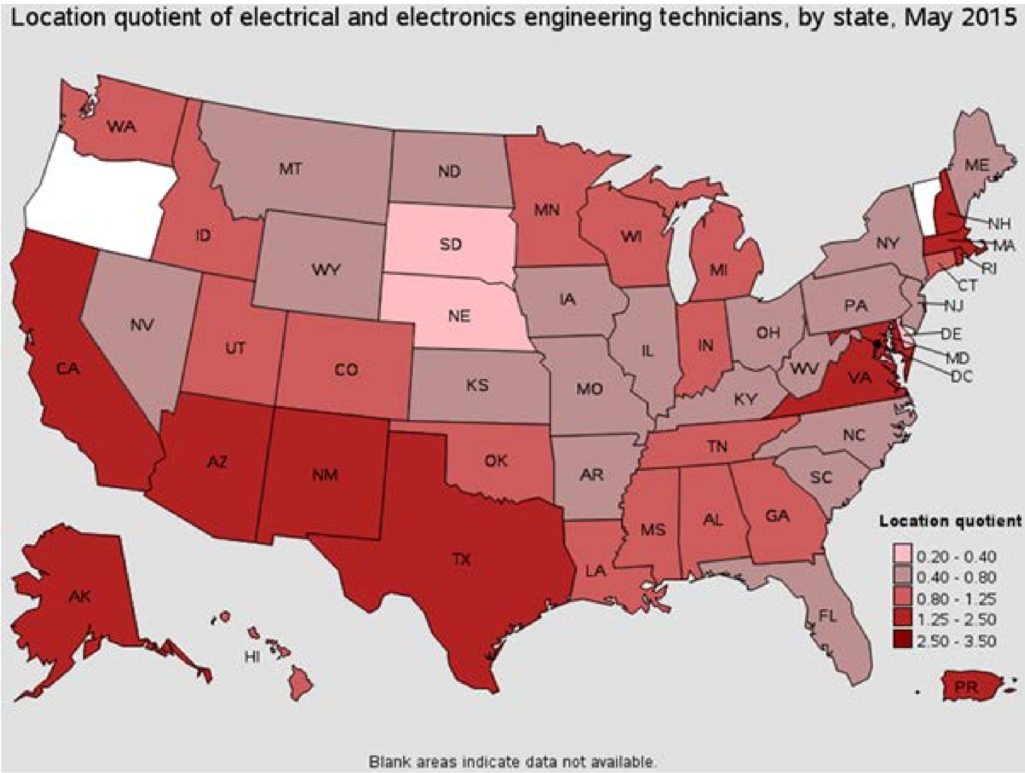
- Optical communications (e.g., fiber optics, lasers, and infrared links),
- Optical imaging (e.g., spy and weather satellites, night vision, holography, flat screen display, and CCD video cameras),
- Optical data storage and optical computing (e.g., CD's and DVD's),
- Optical detectors (e.g., supermarket scanners, medical optics, and nondestructive evaluation of materials),
- Lasers (e.g., welding lasers, laser surgery, laser shows, and laser rangefinders)
- Spectroscopy (e.g., chemical and biological detection, anti-terror detection) and
- Quantum optics (e.g., quantum teleportation, quantum cryptography, and single-photon optics)

5.2 Industry Outlook and Competition

Unfortunately, the U.S. has not kept pace in recent years with other countries (for example, Germany and China) regarding photonics research and development. To improve U.S. competitiveness, in 2012 National Photonics Initiative was created, which supports increased collaboration among private-sector companies, universities, and government on photonics research and commercialization. The NPI is a collaborative alliance among industry, academia and government seeking to raise awareness of photonics and drive US funding in areas critical to maintaining US economic competitiveness and national security. The initiative is led by a coalition of scientific societies, including the American Physical Society (APS), the IEEE Photonics Society (IPS), the Laser Institute of America (LIA), the Optical Society (OSA) and SPIE, the International Society for Optics and Photonics (SPIE).

To further advance U.S. competitiveness in photonics, in July of 2015, The Department of Defense awarded the new Manufacturing Innovation Institute for Integrated Photonics to a consortium of 124 companies, nonprofits, and universities led by RF SUNY. Headquartered in Rochester, NY, the long-time home of optical technology pioneer Eastman Kodak, the new Department of Defense led manufacturing institute was created to spark new growth in manufacturing of optical and photonics technology capabilities—and position the United States for continued leadership in this critical technology area.

Figure 5.1 Electrical and Electronics Engineering Technicians Location Quotient, by State



Source: BLS, May 2015

In New Mexico skills used in the Photonics Sector has a location quotient of 2.05, which suggests the State has significantly higher industry presence than would be expected for its population size.

5.3 Logistical and Supply Chain Issues

The drive for competitiveness and shareholder value has caused corporations in nearly every area of photonics to search for alternative manufacturing locations outside of the United States specifically in Asia. High volume low cost photonics manufacturing has not been successful in the United States. The Asian/North American trade lane is the most active for these products.

- Air freight is the accepted transportation mode for anything time sensitive in the photonics industry
- Ocean transport is now the chosen method of transport for long-term cycle goods such as displays, solar panels and electrical components and subsystems
- For those products made in the United States, they are moved both by truck transport and by air with UPS and FedEx

5.4 Photonics/Optics Scenario

Background:	An East Coast based manufacturer of lasers used in the production of semiconductors and other electronics, and provides various types of lasers to industrial and scientific customers is expanding its manufacturing capabilities to the western US.
Project:	Company is leasing/buying a 55,000 SF building and will be investing $6.3 MM into plant and equipment
Development Proposition:	None, company will lease/buy an existing property
Jobs:	65 high level technical positions
Raw materials sourced:	Western United States
Markets:	Global
Transportation modes:	Truck and air
ABQ Competition:	Tucson, Arizona, Salt Lake City, Utah, and Pasadena, California

Table 5.1 Photonics/Optics Manufacturing Site Decision Factors

Photonics/Optics Site Decision Factors	Albuquerque, NM	Tucson, AZ	Salt Lake City, UT	Pasadena, CA
Transport Costs	0.56	0.63	0.66	0.83
Time in Transit	0.73	1.12	0.99	1.39
Reliability	1.45	1.32	1.72	0.59
Facility Availability and Operating Costs	1.32	1.18	1.40	0.52
Labor Availability and Costs	1.66	1,50	1.14	1.08
Total Tax Burden	0.40	0.30	0.50	0.10
Management Connectivity	0.30	0.25	0.40	0.50
Competitiveness Score	**6.98**	**6.93**	**7.47**	**5.83**

Caveat: This is a real-life simulation of an actual investment project that demonstrated specific requirements that were unique to that company's business situation. No two investment projects are alike, but we can learn from this in reviewing how Albuquerque would have fared if considered a viable competitor. [3]

[3] See page 2-7 (Distribution Profile) for instructions for interpreting the results table.

5.5 Conclusions

In this scenario the competition is very intense but Salt Lake City is the clear winner. Both Albuquerque and Tucson scored well and were ranked very closely, with Pasadena ranked well behind due to reliability, operating costs and high taxes. The Albuquerque or Tucson regions may be considered a serious competitor in this case if Salt Lake City was not able to perform due to preference, or a practical factor such as a specific relationship or program at local universities.

Appendix B.1 Sector Competitiveness Models

Sector: Optics/Photonics/Laser Manufacturing

Project Scenario: Manufacturing facility for laser equipment

	Factor Weighting		Competitor Regions			
Factor	**Group Wgt**	**Individual Wgt**	**Albuquerque, NM**	**Tucson, AZ**	**Salt Lake City, UT**	**Pasadena, CA**
Cost	10%					
Point to point freight costs						
Portland, OR		33%	0.13	0.10	0.26	0.20
Phoenix, AZ		33%	0.30	0.33	0.26	0.30
Los Angeles (LAX) for transpacific shipping		33%	0.26	0.30	0.30	0.33
Factor Total			**0.69**	**0.73**	**0.83**	**0.83**
Time in Transit	20%					
Average transit time for finished product to US destination						
Portland, OR		33%	0.07	0.07	0.33	0.26
Phoenix AZ		33%	0.40	0.66	0.33	0.46
Los Angeles CA (LAX)		33%	0.46	0.53	0.46	0.53
Factor Total			**0.92**	**1.25**	**1.12**	**1.25**
Reliability	20%					
Labor relations ranking		33%	0.40	0.46	0.59	0.07
Latest pick-up time for integrators		33%	0.40	0.26	0.53	0.40
Trucking delays caused by congestion/bottlenecks		33%	0.66	0.53	0.59	0.07
Factor Total			**1.45**	**1.25**	**1.72**	**0.53**
Facility Availability and Operating Costs	20%					
Availability of 50-60,000 SF buildings		60%	0.84	0.48	0.84	0.24
Lease rates for industrial buildings		20%	0.20	0.32	0.24	0.16
Cost of natural gas		10%	0.14	0.18	0.16	0.12
Cost of electicity		10%	0.14	0.12	0.08	0.04
Factor Total			**1.32**	**1.10**	**1.32**	**0.56**
Labor Availability and Costs	20%					
Unemployment rate		10%	0.14	0.12	0.08	0.04
Availablility of workers within a 45 minute commute		30%	0.36	0.36	0.48	0.60
Average salary for photonics workers		20%	0.40	0.32	0.40	0.36
Center of Excellence in photonics		10%	0.20	0.18	0.08	0.04
University/industry partnerships in photonics		10%	0.16	0.20	0.10	0.04
Technical training programs for photonics workers		20%	0.40	0.32	0.00	0.00
Factor Total			**1.66**	**1.50**	**1.14**	**1.08**
Total Tax Burden	5%	100%	0.40	0.30	0.50	0.10
Factor Total			**0.40**	**0.30**	**0.50**	**0.10**
Management Connectivity	5%	100%	0.30	0.25	0.40	0.50
Level of passenger service at nearest airport						
Factor Total			**0.30**	**0.25**	**0.40**	**0.50**
Competitiveness Score			**7.44**	**7.11**	**7.85**	**5.67**

Sector: Aerospace Manufacturing

Project Scenario: Corporate Headquarters/Manufacturing Plant

	Factor Weighting		Competitor Regions			
Factor	**Group Wgt**	**Individual Wgt**	**Albuquerque, NM**	**Phoenix, AZ**	**Wichita, KS**	**Charleston, SC**
Cost	10%					
Point to point freight costs for moving finished goods to market						
Seattle, WA		25%	0.13	0.13	0.10	0.03
East Midlands, UK		25%	0.25	0.25	0.25	0.25
Mobile, AL		25%	0.15	0.10	0.20	0.23
St Louis MO		25%	0.18	0.13	0.25	0.20
Factor Total			**0.70**	**0.60**	**0.80**	**0.70**
Time in Transit	20%					
Average transit time for moving finished goods to market						
Seattle, WA		20%	0.16	0.16	0.12	0.04
East Midlands, UK		20%	0.10	0.10	0.15	0.20
Mobile, AL		20%	0.20	0.16	0.28	0.36
St Louis MO		20%	0.28	0.16	0.40	0.32
2 Day Coverage and Global Gatway Service		20%	0.24	0.20	0.36	0.32
Factor Total			**0.98**	**0.78**	**1.31**	**1.24**
Reliability	20%					
Labor relations ranking		18%	0.22	0.25	0.11	0.36
Latest pick-up time for integrators		30%	0.30	0.30	0.54	0.48
Air transportation delays caused by weather		18%	0.25	0.29	0.11	0.14
Trucking delays caused by congestion/bottlenecks		18%	0.29	0.11	0.25	0.14
Highway impediments: allowable truck size, weight limits		18%	0.25	0.18	0.22	0.22
Factor Total			**1.31**	**1.13**	**1.22**	**1.34**
Facility Availability and Operating Costs	20%					
Availability of 50-60,000 SF buildings		60%	0.72	1.20	0.60	0.36
Lease rates for industrial buildings		20%	0.24	0.08	0.40	0.32
Cost of natural gas		10%	0.10	0.12	0.16	0.14
Cost of electricity		10%	0.20	0.18	0.06	0.18
Factor Total			**1.26**	**1.58**	**1.22**	**1.00**
Labor Availability and Costs	15%					
Unemployment rate		20%	0.18	0.12	0.15	0.09
Availability of workers within a 45 minute commute		20%	0.27	0.30	0.21	0.24
Average salary for electronic technicians		20%	0.18	0.24	0.30	0.09
Technical training programs for electronic technicians		20%	0.15	0.15	0.15	0.15
University degrees for electrical engineers		20%	0.15	0.15	0.15	0.15
Factor Total			**0.93**	**0.96**	**0.96**	**0.72**
Total Tax Burden	5%					
Overall Tax		30%	0.14	0.11	0.15	0.09
FTZ		20%	0.05	0.05	0.05	0.05
Factor Total			**0.19**	**0.16**	**0.20**	**0.14**
HQ Considerations	10%					
Drive time to closest airport with regularly scheduled passenger service		20%	0.10	0.10	0.10	0.10
Level of passenger service at nearest airport		40%	0.32	0.40	0.16	0.24
Direct international air service available		40%	0.00	0.20	0.00	0.00
Factor Total			**0.42**	**0.70**	**0.26**	**0.34**
Competitiveness Score			**6.76**	**6.68**	**7.28**	**6.72**

Sector: Food Manufacturing

Project Scenario: New Food Manufacturing Plant

	Factor Weighting		Competitor Regions			
Factor	**Group Wgt**	**Individual Wgt**	**Albuquerque, NM**	**Santa Teresa, NM**	**Las Vegas, NV**	**Idaho Falls, ID**
Cost	15%					
Point to Point freight costs RM source to plant						
From New York		17%	0.08	0.05	0.03	0.05
From Dallas		17%	0.20	0.20	0.15	0.13
Point to point freight costs moving finished goods to market						
To Portland		17%	0.10	0.08	0.18	0.20
To Los Angeles		17%	0.20	0.20	0.23	0.18
To Seattle		17%	0.10	0.08	0.15	0.20
To Mexico border		17%	0.20	0.20	0.23	0.18
Factor Total			**0.89**	**0.82**	**0.97**	**0.94**
Time in Transit	15%					
Time fom RM source to plant						
From New York		17%	0.20	0.18	0.13	0.15
From Dallas		17%	0.20	0.20	0.13	0.08
Average transit time for moving finished product to market						
To Portland		17%	0.08	0.05	0.15	0.20
To Los Angeles		17%	0.15	0.15	0.23	0.08
To Seattle		17%	0.08	0.05	0.13	0.20
To Mexico border		17%	0.13	0.15	0.23	0.10
Total			**0.84**	**0.79**	**0.99**	**0.82**
Reliability	15%					
Labor relations ranking		20%	0.24	0.24	0.06	0.18
Freight Security		20%	0.24	0.21	0.21	0.30
Trucking delays caused by weather		20%	0.21	0.24	0.30	0.12
Trucking delays caused by congestion//bottlenecks		20%	0.21	0.30	0.15	0.27
Highway impediments: allowable truck size, weight limits		20%	0.24	0.24	0.18	0.30
Total			**1.14**	**1.23**	**0.90**	**1.17**
Facility Availability and Operating Costs	20%					
Availability of 175,000 SF industrial building		50%	0.40	0.20	0.60	0.20
Lease rates for industial buidings		20%	0.32	0.20	0.24	0.28
Cost of natural gas		10%	0.12	0.12	0.08	0.16
Cost of electicity		10%	0.12	0.20	0.16	0.10
Water/sewer capacity for future		10%	0.12	0.04	0.08	0.16
Factor Total			1.08	0.76	1.16	0.90
Total Tax Burden	5%	100%	0.40	0.40	0.20	0.50
Factor Total			0.40	0.40	0.20	0.50
Labor Availabiity and Costs	20%					
Unemployment rate		30%	0.24	0.48	0.36	0.12
Availability of workers within a 45 minute commute		30%	0.48	0.36	0.60	0.24
Average salary for food processing workers		30%	0.48	0.60	0.24	0.54
Technical training programs for food processing workers		10%	0.10	0.10	0.00	0.00
Factor Total			1.30	1.54	1.20	0.90
Environmental Regulations for Bakeries	10%	100%	0.50	0.50	0.50	0.50
Factor Total			0.50	0.50	0.50	0.50
Competitiveness Score			**6.15**	**6.04**	**5.92**	**5.73**

Sector: Consumer Goods Distribution

Project Scenario: Regional Distribution Center for Food Industry Redistributor

	Factor Weighting		Competitor Regions			
Factor	**Group Wgt**	**Individual Wgt**	**Albuquerque, NM**	**Kingman, AZ**	**Amarillo TX**	**Bakersfield, CA**
Cost	**25%**					
Point to point freight costs moving goods to market						
Los Angeles CA		25%	0.38	0.50	0.25	0.63
Las Vegas NV		25%	0.44	0.63	0.31	0.50
Phoenix AZ		25%	0.50	0.56	0.38	0.44
Salt Lake City UT		25%	0.38	0.44	0.31	0.38
Factor Total			**1.69**	**2.13**	**1.25**	**1.94**
Time in Transit	15%					
Average transit time for goods from distribution center to market						
Los Angeles CA		25%	0.11	0.26	0.08	0.34
Las Vegas NV		25%	0.19	0.38	0.11	0.26
Phoenix AZ		25%	0.23	0.34	0.11	0.19
Salt Lake City UT		25%	0.15	0.26	0.08	0.15
Factor Total			**0.68**	**1.24**	**0.38**	**0.94**
Reliability	15%					
Labor relations ranking		25%	0.26	0.30	0.34	0.08
Trucking delays caused by congestion/bottlenecks		25%	0.23	0.38	0.26	0.34
Highway impediments: allowable truck size, weight limits		25%	0.26	0.19	0.19	0.19
Factor Total			**0.75**	**0.86**	**0.79**	**0.60**
Facility Availability and Operating Costs	15%					
Industrial sites with immediate interstate accesss		50%	0.60	0.30	0.45	0.75
Cost of improved land		30%	0.36	0.27	0.45	0.18
Certified site program		10%	0.00	0.00	0.00	0.08
Cost of electicity		10%	0.12	0.06	0.09	0.03
Factor Total			**1.08**	**0.63**	**0.99**	**1.04**
Total Tax Burden	10%	100%	1.00	0.60	0.80	0.40
Factor Total			**1.00**	**0.60**	**0.80**	**0.40**
Labor Availabiity and Costs	20%					
Unemployment rate		33%	0.40	0.53	0.13	0.66
Size of workforce within a 45 minute commute		33%	0.53	0.13	0.26	0.66
Average salary for warehouse/distribution workers		33%	0.40	0.46	0.53	0.40
Factor Total			**1.32**	**1.12**	**0.92**	**1.72**
Competitiveness Score			**6.51**	**6.58**	**5.13**	**6.63**

Appendix B.2 Competitiveness Assessment Scores

Demographic Data

- U.S. Census Bureau
- BLS
- ERI

Transportation Costs

- Freight Rate Index.com
- Google Maps
- Rand McNally Mileage Calculator

Business Reliability

- Tom Tom Congestion Index,
- BLS
- Freight Delay by Weather TTI
- Annual Truck Delay TTI
- Dat Solutions
- FreightWatch
- RITA

Land and Building Availability and Cost

- CBRE
- Colliers
- CARNM

Labor Availability, Wages, Salaries, Statutory Plans and Benefits

- BLS
- ERI
- Tax Fact KPMG
- Mercer—U.S. Geographic Salary Differentials

Utilities

- U.S. Energy Information Administration
- El Paso Electric

Regional and Local Taxes

- National Conferences of State Legislators
- City of Albuquerque Treasury Department

- Dona Ana County Assessor
- State of New Mexico Taxation and Revenue
- Potter-Randall Appraisal District
- Texas Comptroller of Public Accounts
- Kern County Treasurer and Tax Collector
- County of LA Department of Auditor and Controller
- California Franchise Tax Board
- Charleston County Treasurer
- South Carolina Department of Commerce and Tax Department
- Idaho State Tax Commission
- Bonneville County Treasurer and Tax Collector
- Arizona Department of Revenue
- Mohave County Treasurer
- Maricopa County Finance Department
- Pima County Treasurer
- Nevada Department of Taxation
- Clark County Treasurer
- Utah State Tax Commission
- Salt Lake County Auditor
- Sedgewick County Clerk
- Kansas Department of Revenue