IDENTIFYING AND ASSESSING THE FACTORS THAT INFLUENCE CLUSTERS' COMPETITIVENESS IN OREGON, AND SOME INITIAL SUGGESTIONS

by

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"Identifying and Assessing the Factors That Influence Clusters' Competitiveness in Oregon, and Some Initial Suggestions," a thesis prepared by Sam Gi Hong in partial fulfillment of the requirements for the Master of Public Administration degree in the Department of Planning, Public Policy and Administration. This thesis has been approved and accepted by:

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The cluster has become one of the most popular regional economic development approaches since Michael Porter published his landmark book. Following Porter's approach, Oregon is trying to develop regional industries from the cluster perspective. First, this paper introduces Porter's theory to explain the cluster's popularity in the era of globalization. Second, to find Oregon's competitive advantages and disadvantages, this research analyzes three clusters (high tech, forest, and food and agriculture) that were identified as Oregon's three biggest clusters from a previous study. The analysis finds that the three clusters are competitive in terms of employment growth and employment concentration rates. However, it also finds that the clusters cannot provide higher wages for their workers than their national competitors because they do not rely on innovative

technologies that differentiate their products. Lastly, this paper suggests policy recommendations that can contribute to Oregon's competitive advantages for general industries.

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CHAPTER I

PROBLEM STATEMENT

1. INTRODUCTION

The cluster has become the most popular regional economic development approach for regional policy makers and businessmen. One of the most striking features of regional economies, especially in advanced economies, is the presence of clusters (Porter et al., 2004). Silicon Valley, the most successful and popular cluster in the world, is often cited as the desirable economic development model every nation needs to follow for building 'another Silicon' in its country. Cluster Initiatives (CIs)—organized efforts to increase growth and competitiveness within a region, involving cluster firms, government and/or the research community—has become a central feature in economic development (Sölvell et al., 2003). Sölvell and his team identified more than 500 CIs, conducting 'The Global Cluster Initiative Survey' in 2003.

What is a cluster? There is no generally accepted definition of it; most definitions of the cluster add some ingredients to the basic notion of spatially concentrated firms and focus on external effects and interaction (Altenburg, et al., 1999). According to Porter (1998) (who has inspired policy makers all over the world to seek regional economic development by developing clusters in their regions since his book, *The Competitive Advantage of Nations*, was published in 1990 (Sölvell et al., 2003, Meyer-Stamer, 2000, and Hospers, et al, 2002)), the cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. According to his definition, clusters are formed in limited areas with firms and institutions that interact with one another, and the firms are formed around closely related industries and supporting industries. (1) Why do firms want to locate themselves near other firms? (2) Why cannot a region show prominence in diverse industries? Why does a region have a prominence in a few industries that are connected by

commonalities and complementarities? The answers to these questions will explain the popularities of clusters and provide the information necessary to develop clusters (chapter 2).

Oregon is also trying to develop its economy through cluster approaches.[1] The efforts to develop Oregon's economy through clusters are prevalent throughout the state and all the sectors of its industries. The Oregon Business Council[2] (OBC) especially has been playing an important role in developing Oregon's clusters. In 2002, OBC launched the 'Oregon Business Plan (OBP).' OBP aims to provide initiatives to make the Oregon economy more strong through making Oregon firms more competitive and providing favorable living conditions to attract talented people who are necessary to upgrade regional firms' productivity. Every year OBP tracks its achievements and suggests new initiatives based on regional business groups' suggestions. OBP envisions that traded industry clusters which sell products and services outside of the state and bring money into the state will support Oregon's economy.

Besides OBP, OBC launched the 'Oregon Cluster Network' to find and address the needs of regional clusters as well as to identify existing clusters in Oregon. Oregon Cluster Network has identified 31 clusters that have been formed voluntarily by their members.[3]

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[1] Seeing the whole state area as a cluster seems to be contrary to Porter's definition and general people's understanding of clusters: Silicon Valley is formed only through the southern part of the San Francisco Bay area (CA), and 'Route 128' is located along Highway 128 in Westwood (MA). However, a state's characteristics, such as economic laws, people's preferences, regional natural resources, universities, and locations, produce a unique business environment that is distinctive from other states. Moreover, as we can see from OBC's efforts above, the state is an important boundary in regional collaborations among regional businessmen. I believe the boundary of a cluster is not a fixed one; the boundary is flexible according to people's focus on regional levels.

[2] The Oregon Business Council is a nonpartisan organization composed of more than 40 business CEOs and executives. Since 1985 when OBC was founded, it has focused on public issues that affect people's lives and the state's economy (http://www.orbusinesscouncil.org).

[3] When there is an established network among people of related industries, the Oregon Cluster Network (OCN) regards it as a cluster. However, the definition of cluster does not

The clusters are formed from all the areas of industries: software, nanotechnology, bioscience, apparel and sports, agricultural and food, metals, forest products, fishery, tourism and hospitality, nursery, etc. The cluster members communicate with each other to share their knowledge and experiences, suggest policy initiatives that are necessary to increase their productivity, establish research centers for education programs or researches tailored to their needs, and hold periodic forums where the business leaders and governmental officials can share thoughts and experiences with each other.

2. BACKGROUND

In the era of global economy when many production factors, such as skilled workers, natural resources, capital, etc. can be easily transferred to any nation or region at a low cost, and the developed communication technology enables people to contact anyone anytime, the fact that the cluster usually located within a specific area is gaining importance is a paradox. However, the paradox is clearly explained by M. Porter's book, '*The Competitive Advantage of Nations*' (1990).

In his book, Porter insists that the industry's success is influenced by the national (regional) determinants that are unique to the nation (region), and that the industries can have competitive advantages when the nature of clusters in the region matches with the national determinants. Porter illustrates how the four determinants of national competitive advantages (Factor Conditions, Demand Conditions, Related and Supporting Industries, and Firm Strategy, Structure, and Rivalry) and their interactions play important roles in deciding the industry's competitiveness. This paper deals with his theory in detail in the literature review section (chapter 2).

Considering that clusters are formed among traded sectors that sell their products outside the region and bring the money into their local areas, traded sectors' competitiveness decides the regional wealth. Thus, clusters' competitiveness can be

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require an organization in the cluster, even though the cluster needs interactions among related firms. However, their clusters found by OCN shows the existences of diverse industry clusters that comprise firms of related industries.

inferred from traded sectors' competitiveness.

According to the *2007 Competitive Index: Indicators of Oregon's Global Economic Comparativeness*, the current competitiveness of the clusters in Oregon cannot be appraised high. Oregon ranked 33rd among 50 states in the Traded Sector Strength Index that is decided by the 'traded sector income per worker'. Among 13 traded sectors[4], only 3 sectors' average incomes are higher than the national average (Apparel & Sporting Goods: 211.1%, Electronics: 112.8%, and Forest Products: 101.6%, compared to the national average of 100%). Manufacturing Gross State Product Index indicates that Oregon's traded sectors' produced $27.18 billion in 2005, which is below the national average of $29.93 billion. However, according to the Employment Growth Index of traded sector, Oregon enjoyed a more rapid growth rate than other states last year ('05~'06: 3.1%, 9th) and over the past three years ('03~'06: 9.1%, 7th). The competitive index above shows that Oregon's clusters do not have a high level of competitiveness.

In order to transform Oregon clusters into more competitive ones, information is needed about what Oregon's competitive advantages and disadvantages are, what the long term effects of the advantages and disadvantages are, and what actions are needed to keep and upgrade the clusters' competitiveness.

3. PURPOSE OF THE RESEARCH, GENERALIZATION OF THE RESEARCH'S RESULTS, AND METHODOLOGY

First, this paper will identify and assess the diverse factors that influence clusters' competitiveness in Oregon as well as assessing three Oregon clusters' competitiveness. Identifying and assessing the factors will provide a useful guide to business leaders and policy makers to make policy initiatives for increasing the clusters' competitiveness in Oregon. Second, this paper will recommend necessary initiatives for keeping and upgrading the clusters' competitiveness.

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[4] Electronics, professional service, forest products, metals, apparel/sporting goods, food processing, transportation equipment, machinery, software publishing, accommodation, nursery, plastic/rubber, and nonstore retail.

The paper will focus on three clusters (high-technology & software, forestry, food processing and agriculture) that are identified as the three biggest clusters in Oregon from Cortright and Impressa Consulting's Research (2003). Even though this paper focuses on the three clusters, its findings will help to understand Oregon as an environment for general industries.

To find out the three clusters' competitiveness level, this paper will rely on quantitative methodology: the specific method in the quantitative method will be discussed in the chapter 3. To identify and assess the factors that influence the three clusters' competitiveness, this paper will rely on qualitative methodology. This paper will use Porter's 'The Determinants of National Advantage' model (Porter, 1990) as a basic analytical framework. Other research findings about industries' competitiveness could also provide additional analytical frameworks. Diverse forms of data, such as governmental documents or reports, statistical data, local journal reports, public or private organizations' websites, and any information source that is reliable, will be collected for the analysis.

In the next chapter (chapter 2), this paper will review literature to find some frameworks for understanding Oregon as business environment and suggesting policy initiatives to transform Oregon into a better business environment. In chapter 3, the three Oregon clusters' competitiveness will be assessed through quantitative methods. After the quantitative method, each of the three cluster's competitive advantages and disadvantages will be identified and assessed in term of their long term effects on the clusters' competitiveness. Lastly, in chapter 4, the necessary policy initiatives to improve the business environment in Oregon and the recommendations for further researches will be presented.

CHAPTER II

LITERATURE REVIEW

This chapter reviews the literature on clusters to find answers for two questions that must be addressed to achieve the purpose of this study: identifying factors that influence Oregon clusters' competitiveness and suggesting some initiatives to develop them. One question is "why do firms want to locate themselves near other firms in limited areas?" The other question is "why does a region have a prominence in only a few kinds of industries that that are connected by commonalities and complementarities?" The answers to the two questions will also answer the questions Marshall. A (1920) [5] had about 100 years ago.

Marshall paid attention to the phenomenon of localization that some products are produced only in a few places, or even in one place, and sold all over Europe. He suggested some factors as causes of the localization, such as physical conditions (climate, soil, or easy access through land or water), patronage of a court that invites artisans and settles them in a group, opportunity for workers to learn skills unconsciously, the chance to contact a new idea and improve it, economic use of expensive machinery in a large aggregate production, easy access to skilled workers, etc. Marshall also refers to the negative effects of a cluster when clusters depend on one kind of industry. He says that iron industries usually employ only strong men and give them high wages, but the family incomes are low because women or children cannot be hired in the region. He adds another example that if a district depends on one product, the district would face extreme depression in case of a decrease in the product's demand. Even though his explanation is not well organized, as Krugman (1991) says, Marshall has a fairly sophisticated model in mind.

Why do firms want to locate themselves near other firms (in most cases, their

[5] Krugman (1991) says that Alfred Marshall's work, *The Principles of Economics* (1890), is the source of the extensive literature on industrial localization that emerged throughout the twentieth century. Porter (1998) also says that the intellectual antecedents of cluster theory date back at least to Marshall.

competitors) in limited areas? From his recent work (1998, 2004), Porter illustrates the reasons why firms want to locate within a cluster; Porter explains the role of firms' geographic concentration in his 1990 book, but the explanation is not as clear as that of his recent works. He believes clusters affect competition in three mechanisms. First, the cluster increases productivity, which can be achieved by diverse ways, such as easy access to information, technology, and skilled workers, low transaction costs, and well-established infrastructure. Second, the cluster fosters innovation through the competition with rival companies or through active interaction among related companies. Third, it facilitates commercialization of innovation. For example, establishing a new company in a cluster is easier than elsewhere because of the presence of all necessary inputs for starting businesses.

Why do a region have a prominence in only a few kinds of industries that that are connected by commonalities and complementarities? Porter's 'The Determinants of National Advantage' model (Figure 1.) in his 1990 book provides an answer to this question. Even though Porter is talking about 'national' competitiveness in his model, his theory—as he admits in his book—can be readily extended to explain why some cities or regions are more successful than others. Meyer-Stamer (2000) claims that Porter's 1990 book is in fact much more about sub-national regions than nations. I believe that the concept of region is the ideal geographical area of Porter's model, given that interactive economic activities often appear within a region that is usually formed independent of a city, a state, or even a nation's boundary; the region has its own boundary within which interrelated economic activities that are distinctive from activities outside take place.

In the model Porter (1990) suggests the following factors as determinants of national (regional) competitive advantage: (1) factor conditions: the nation's position in factors of production, such as skilled labor, capital, infrastructure, (2) demand conditions: the nature of home demand for the industry's product or service, (3) related and supporting industries: the presence or absence of supplier industries and related industries that are internationally competitiveness, and (4) firm strategy, structure, and rivalry: the conditions in the nation governing how companies are created, organized, and managed, and the nature of domestic

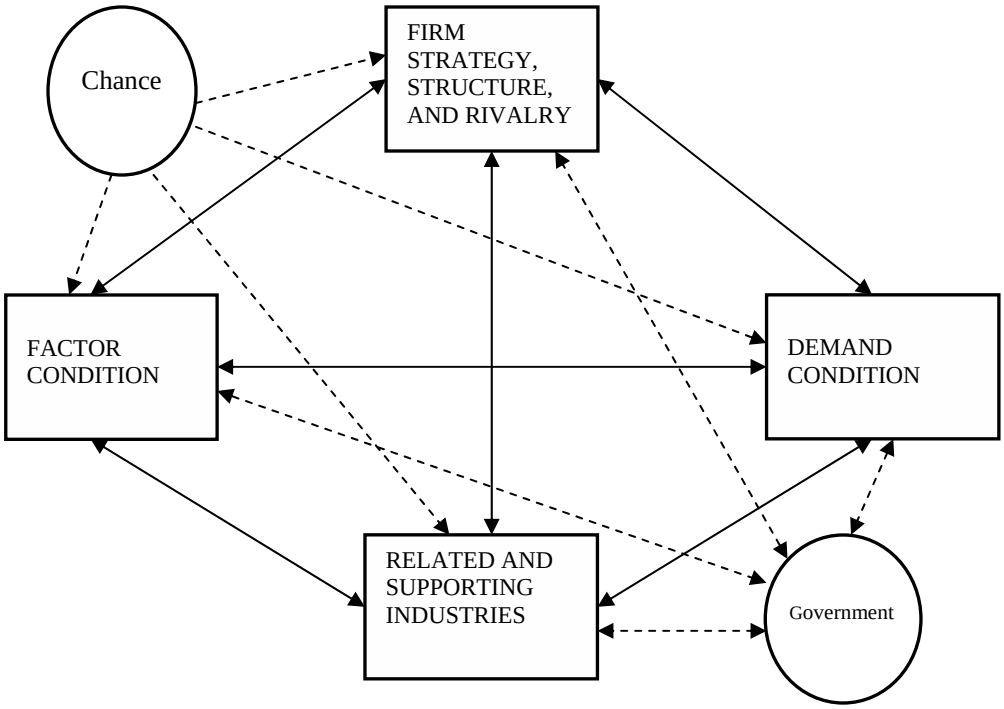

Figure 1. Porter's 'Determinants of National Advantage' Model

rivalry. He adds that 'chance' and 'government' also influence national competitive advantage. However, their influence is indirect; they affect regional firms' productivity through affecting the four determinants.

Porter insists that the four determinants produce unique national competitiveness advantages of each nation, and that the unique advantages cause each nation to have different competitive industries. He also argues that strong competitive industries appear where the national competitive advantages are more favorable for the industries.

Porter adds that effects of national competitive advantage on industries' competitiveness are not 'static' but 'dynamic.' For example, technologies cannot be competitive source when new technologies emerge. Competitiveness based on easily replicable, transferable, or substitutable factors, such as natural resources, cheap workers, debt capital, etc, will not persist for a long period of time because competitors can also get

the same resources without much difficulties. Moreover, some factors that contribute to an industry's growth at the early stage could become unfavorable factors that deteriorate the industry's competitiveness (e.g., abundant domestic demand can cause an industry's rapid growth especially in early stage, but the industry could lose its competitiveness in the long term because of it; domestic industries do not feel to feel necessity to innovate their products, satisfied with the abundant home demand). Porter adds that the four national determinants form a system in which the four determinants influence and reinforce each other. The interplay of the four determinants results in a unique environment that cannot be replicable in other regions, which is the region why the region is still an important factor in global economy.

In this chapter the paper provided a framework to analyze Oregon clusters relying on Porter's books. In next chapter the paper will analyze Oregon clusters to find the clusters' competitive advantages and disadvantages.

CHAPTER III

METHODOLOGY

1. QUANTITATIVE METHOD

I use both quantitative and qualitative methods for the research. Through a statistical approach, the research finds the general competitiveness level of the clusters as well as their contributions to Oregon economy. For the statistical analysis, this research borrows the method Joseph Cortright and Impressa Consulting (2003) used to identify existing clusters in Oregon through a statistical approach. The research identified 11 clusters,[6] using three indicators: relative wage, relative growth rate, and Location Quotient (L.Q.) Using both the U.S. Standard Industrial Classification (SIC) Code and the North American Industrial Classification System (NAICS),[7] the research regarded the industries as industries in clusters when the firms in the industries show economic performances that met at least one of the three indicators. To be regarded as industries in clusters, the firms in the industrial codes needed to show a higher average wage than the national average by 10%, or a higher employment growth rate during a 5 years period (1995 through 2000) than the nation by 20%, or a L.Q. value that is 1.25 and more (If the firms in an industrial code in Oregon employ 2% of the Oregon total employment and the firms in the same code in the U.S. employ 2% of the U.S. total employment, the Oregon's L.Q. is 1. If Oregon has a higher (smaller) employment ratio than the nation, the L.Q. is above (below) 1)

This research uses the indicators that Cortright and Impressa Consulting used in their research: relative wage, relative growth rate, and the L.Q. This is because the three

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[6] High technology/software, wood and paper products, food processing and agriculture, apparel & sporting goods, transportation equipment, creative services, recreation-related, metal/machinery, nursery products, professional services, and biomedical clusters.

[7] NAICS replaced SIC since 2001, and it was co-developed by the U.S. Canada, and Mexico to make it easy to compare business activities across North America

indicators can also be good competitive indicators: if firms in an Oregon industry pay higher wages to their workers than the national average, they can afford to give higher wages because they can make more profit than their national competitors. If Oregon firms show a higher employment growth rate or L.Q. value, they might be caused by the firms' competitiveness. This research relies on the three indicators of all industries in each cluster to find the cluster's competitiveness.

However, this research's approach is a little different from Cortright and Impressa Consulting's method: While they excluded the industries from clusters when the firms in the industries did not meet at least one of the three indicators, this research includes all related industries of each cluster, and finds their average wages, relative growth rates, and L.Q. values to find the general competitiveness level of each cluster. This is because the cluster does not mean that every industry in the cluster is competitive; even the most competitive cluster might depend on other regions for some parts of their activities.[8]

I believe that the three indicators represent different aspects of competitiveness. According to Porter (1991), there are two strategies for firms to choose: one is "lower cost," and the other is "differentiation." He adds that pursuing both of the two strategies at the same time is very difficult--even though it is not impossible--because the two strategies are incompatible in nature: to differentiate products, firms need to hire high skilled workers or use high quality materials. When firms are competitive in differentiation, they could provide relatively higher wages to their workers in addition to hiring more workers. However, the firms who competitive in low costs would not be able to give higher wages to their workers even though they can hire more workers. This situation can be easily understood when comparing two imaginary clothes makers: a competitive clothes maker in

[8] The basic purpose of Cortright and Impressa Consulting's research was to identify the existing clusters in Oregon. Thus, they had to find industries that showed higher economic performances than national averages to finding existing clusters because they thought that if an industry was in an cluster, it might show higher economic performances. However, the purpose of my research is not to identify existing clusters but to assess the competitiveness level of Oregon clusters. Thus, my research needs to look at all the industries in clusters that are already identified in the Cortright and Impressa Consulting's research.

Italy and a competitive clothe maker in Vietnam. When firms' relative wages are higher than their competitors, their competitiveness must be based on differentiation. However, the fact that firms hire more workers than their competitors only indicates that the firms are competitive in price but not quality. I also want to point out the different aspect of the employment growth rates and L.Q. values. Competitive firms (whether their competitiveness is based on differentiation or low costs) do not continuously increase their employments. At some points, they will stop increasing their employments. In this case, the L.Q. values could tell their competitiveness. To understand regional firms' competitiveness, we need to pay attention to these three indicators at the same time.

For the analysis, I used wage and employment data from Bureau of Labor Statistics (BLS). The data have been based on the NAICS since 2001. For the relative wage and the L.Q. indicators, I used 2005 data, and for the relative growth rate, I used 2001 and 2005 employment data. The relative wage and relative growth rate are calculated as follows (the definition of L.Q. was illustrated above):

- Relative wage = ('05 Oregon average wage – '05 national average wage)/ '05 national average wage * 100%
- Relative growth rate = {(the number of '05 Oregon employees - the number of '01 Oregon employees)/ the number of '01 Oregon employees} * 100% - {(the number of '05 national employees - the number of '01 national employees)/ the number of '01 national employees}* 100%

The analysis used data at 5-digit code level. However, this analysis also used data at 6-digit level when there were irrelevant industries in the 5-digit industry categories, or the industries in the same 5-digit category are different and need to be dealt with separately.

There are a few limitations in this statistical analysis. First of all, the industries this research included for the analysis were decided by my own judgments after reading the definitions of '2002 NAICS Code' from the website of the U.S. Census Bureau[9]; there might be more industries that are parts of the clusters but I missed in the process of

[9] http://www.census.gov/epcd/www/naics.html

searching related industries from the over 2,000 industry codes. Another important limitations of this analysis is that I could not include research, education, and other service institutes in this quantitative analysis because they could not be deal with in relation with a specific cluster. For example, the universities' roles in cluster are important, but the code for 'Colleges, Universities, and Professional Schools (NAICS 611310)' does not have detailed information that can be considered in relation with a specific cluster. The BLS data themselves were often unavailable in some industrial codes. In interpreting the results of this statistical analysis, there is an important point to keep in mind. In this research, the relative wage and L.Q. data are based on only one year's data. Thus, when the Oregon's relative wages and L.Q. values are slightly better than the nation, it does not have much meaning because both of them vary every year, even though employees' wages and their status of employment cannot change as fast as the economic situation's changes. Readers need their own thresholds to interpret the results as meaningful numbers.

2. QUALITATIVE METHOD

To analyze Oregon as a business environment for each cluster, I relied on diverse materials: academic thesis, governments' reports and public relation documents, news articles, and public and private organizations' websites. The main objective of this qualitative analysis is to assess Oregon as an environment for each of the three studied clusters: high tech cluster, forest cluster, food processing and agriculture cluster. I learned that the cluster efforts in Oregon are vibrant as this paper illustrated before, but the studies of Oregon from the cluster perspective are in early steps. I found three ground breaking researches about the Oregon clusters. One is Porter's research (2002), which illustrate each cluster's economic performance, such as wages, employment, and job creation. The other is the Cortright and Impressa (2003)'s research that identified principal clusters with employment data, and another is Oregon Economic and Community Development Department (OECDD) (2006)'s research that finds each cluster's core industries and specialized suppliers. All of these three researches are using statistical approaches. Thus, this paper's qualitative analysis will supply in-depth information of Oregon as a business

environment, which cannot be obtained from the quantitative method.

CHAPTER IV

CLUSTER ANALYSIS

1. HIGH TECH CLUSTER

(1) The Overview of the High-Tech Cluster

The term “high-tech industry” means different industry to different people. There is no generally accepted definition of high-tech industry. In Cortright and Impressa Consulting’s research (2003), the high technology and software cluster was identified as the biggest cluster in Oregon. However, the research included such diverse industries that the cluster boundary did not appear clear, and the business environments for the industry could not be dealt with together (e.g., the market demand of ‘industrial machinery and equipment product industry’ is irrelevant to that of ‘software product industry’)

This research depends on the Oregon Department of Employment (ODE)’s definition of high-tech industry, which includes industries corresponding to three NAICS codes: computer and electronic product manufacturing (NAICS 334), system design and related services (NAICS 5415), and software publishing (NAICS 5112). The computer and electronic products’ manufacturing processes are different from other machinery and equipment, and the use of integrated circuits and the application of highly specialized miniaturization technologies are common elements in the production of the computer and electronic products (2002 NAICS definition). Thus, ODE’s definition includes computer and electronic products, computer software, and related services, such as managing and operating computer system and technical supporting service. I included computer and software stores (NAICS 44312) to the high tech cluster for the cluster’s quantitative analysis because the retailers are a part of the cluster.

From table 1, we can see the cluster’s contribution to Oregon economy. The cluster employs 58,156 workers and pays $4.6 billion for their wages, which are 4.2 percent of

Table 1. High Tech Cluster's Wage, Employment, and Concentration Analysis ('01~'05)

NAICS, Name	'05 Establishments	'05 Average Wage	'05 Employment	'05 Payroll ($1,000)	'05 Relative Wage	'01~'05 Relative Growth	L.Q. in 2005
Computer and Electronic Products Manufacturing							
33411 Computer and Peripheral Equipment Manufacturing	34	70,383	3,817	268,653	-32%	1%	1.50
33421 Telephone Apparatus Manufacturing	7	67,906	96	6,547	-24%	-31%	0.18
33422 Radio, Television Broadcasting and Wireless Communications Equipment Manufacturing	5	64,956	241	15,627	-16%	-40%	0.25
33429 Other Communications Equipment Manufacturing	11	46,363	869	40,293	-25%	32%	2.67
33431 Audio and Video Equipment Manufacturing	12	50,806	444	22,541	-13%	44%	1.09
33441 Semiconductor and Other Electronic Component Manufacturing	162	85,347	29,866	2,548,973	20%	16%	5.33
33451 Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	107	72,263	5,584	403,522	-2%	-9%	1.03
33461 Manufacturing and Reproducing Magnetic and Optical Med	8	38,816	109	4,244	-39%	708%	0.20
Software Publisher							
51121 Software Publishers	467	84,137	7,275	612,093	-16%	-8%	2.45
Computer System Design and Related Service							
54151 Computer Systems Design and Related Services	1506	69,504	8,575	595,970	-13%	-19%	0.57
Retailers							
44312 Computer and Software Stores	146	33,933	1,280	43,449	-40%	13%	0.69
Total			**58,156**	**4,561,912**			

<Source: Bureau of Labor Statistics, U.S. Department of Labor>
ND: Not Disclosable, data do not meet BLS or State agency disclosure standards.
NC: Not Calculable, data do not exist or it is zero.
For more detailed information, please see the appendix A.

total private employees and 9.1% of total Oregon private workers' payrolls, and the data show that the cluster workers get more than two times those of Oregon's private workers' average wage of $36,230 in 2005[10].

(2) Recent Performance Analysis

Unlike the high-tech cluster's substantial contribution to the Oregon Economy, the data from table 1 show that the cluster does not have high competitiveness compared with its national competitors in terms of the relative wage. Surprisingly, the industry that shows higher average wage than the national average is only 'Semiconductor and Other Electronic Component Manufacturing (33441)'; Oregon is higher than the national average

by 20%. All the other 11 industries in the cluster pay lower wages to their workers than their national averages, which illustrates that most Oregon high tech industries do not make more profits than their national competitors.

The relative growth rate does not show that the high-tech cluster's employment growth is higher than the national competitors'. In 6 industries Oregon shows higher employment growth rates than the national averages, while in 5 industries Oregon shows lower employment growth rate than the nation averages. The L.Q. value also does not indicate that the high tech industries concentrate more in Oregon than the national averages. In 6 industries L.Q. indicators are less than 1, while in 5 industries they are greater than 1.

(3) Oregon as an Environment for the High Tech Cluster

In the words "Silicon Forest," there is Oregon's pride over its success in developing high tech industries as the most profitable industries in the state despite the weak resources for the industries, such as innovative universities[11] that can provide state-of-the-art

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[10] Source: Bureau of Labor Statistics Data

[11] Judging from the number of patents issued by the U.S. universities from 1999 to 2003, Oregon universities do not work as competitive resources for the region's high tech firms: Oregon Health Sciences University ranked 75th among all U.S. universities, Oregon State University 135th, University of Oregon 206th, Oregon Graduate Institute of

technologies and high-skilled workers[12] for the industries.

Oregon seems to have some competitive advantages as an environment for high-tech industries despite its weak resources. Oregon is an attractive place to live in for high-tech workers. Florida (2004) says that the high tech industry workers have a preference to live in an open society where their diverse ideas and ways of life are respected and guaranteed. He insists that we need to transform our society into a more open place if we want to develop high tech industries in our region. He suggests the 'gay index' as an indicator to measure the level of openness in a region. Florida explains that gays also want to live in an open society, and that the cities where gays congregate strongly correspond to the cities where high tech industries flourish. According to the gay index, Portland where most high tech firms in Oregon are located ranked 20th among 49 metropolitan areas with over 1 million populations. Eugene, one of Oregon's high tech industry's bases, is among the top 20 of all cities in the U.S. on the gay index. The two cities relatively open social atmosphere contributes to the high tech industries' development in Oregon.

Oregon's favorable living conditions attract high tech companies from California and other regions. Gerry Perkel, the CEO of software company Merant, said, "Oregon is a more favorable place than California in terms of quality of life: a K-12 public education system that, while showing cracks, still looks better than what many California cities have to offer; affordable housing; and easy access to the great outdoors" (Heartman, Nov. 2003).

Science and Technology 273rd, University of Portland 352nd, and Portland State University 422nd (Porter, 2006).

[12] According to Oregon State University's recent report, *2006 Annual Report*, Intel, the largest employer in Oregon, depends on workers outside of Oregon for 90 percent of its high-end work force because of Oregon's lack in Ph.D graduates. The report emphasizes that the Ph.D graduates are the source of global competitiveness in high tech companies, such as Intel, HP, Pixelworks, and Xerox because the Ph.D graduates create new, innovative technologies for the companies.

Oregon's relatively cheap living costs compared to California[13] also make Silicon Valley based firms consider Oregon as a potential site for their expanded facilities when they search places for their new facilities

Oregon's proximity to Silicon Valley played an important role in developing Oregon's high-tech industries.[14] As the firms in Silicon Valley succeeded and expanded their facilities, they had to find places for their new facilities and their workers. For the firms searching for new places, nearby Oregon was an attractive place that had a lot of advantages above in addition to its proximity to Silicon Valley. Intel, one of world-renowned firms based in Silicon Valley, has grown to become Oregon's largest employer since Intel built its first facility in Aloha in 1976. Intel employs approximately 16,000 workers in Oregon at the moment, and Oregon is the largest Intel site. Intel's former workers made their own start-ups, such as the Lattice Semiconductor Corporation and the Sequent Computer Systems. IBM (Beavorton) acquired the Sequent Computer Systems in 1999, which became a chance for another world-renowned Silicon Valley based firm to invest in Oregon (Intel Corporation[15]). Hewlett Packard (Corvallis), Google (Dalles), and Yahoo (Hillsboro) are all companies that based in Silicon Valley and have significant facilities in Oregon. These famous companies' successes in Oregon make the place more attractive place for high tech firms in other region. Jim Carven, Director of Legislative and Public Affairs for the American Electronics Association (AeA), said, "The really big leading companies explored Oregon, which sort of sent a signal that maybe it's worth

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[13] If a workers who earns $70,000 in Portland (OR) moves to San Francisco (CA), the worker need to earn $103,832 (48.33% more) to maintain the same standard of living (http://www.bankrate.com/brm/movecalc.asp).

[14] The physical proximity is an important factor that affects business decision in locating sites for expanded facilities. For example, Intel's expanded facilities in the U.S are generally located in areas near the headquarter in Silicon Valley, such as Oregon (1976), Arizona (1976), New Mexico (1980), Utah (1991), Colorado (2000), Texas, and Washington. Intel also has its facilities in Massachusettes and New Jersey. However, the facilities in the east coast area might be affected by the areas' abundant resources for the high tech industries (e.g., the high tech cluster around the Route 128 in Boston)

[15] http://www.intel.com/community/oregon/campus/key.htm

exploring" (Rogoway, 2007 Mar. 17).

However, the crucial weakness of Oregon as an environment for high tech industry lies in the fact that Oregon does not have strong research universities, as this paper illustrated specifically above (footnote 11). The university's role cannot be exaggerated in terms of the development of the high-tech industry. Universities are the sources of highly skilled workers and technologies that high tech firms depend on for their competitiveness. Moreover, the social network formed based on universities promotes cooperation between the firms in the region[16], and the social network works as a stronger competitive advantage because it cannot be moved or replicated in other regions. Behind the high-tech industry cluster's success, there are always universities: Standford is behind Silicon Valley, MIT is behind the greater Boston area, and something similar has emerged in Austin, Texas and the North Carolina Research Triangle (Florida et al., 2006).

Oregon's weak research base led to inactive establishment of Oregon based start-ups, and Oregon had to depend on the firms based in other regions for its high-tech industry development.[17] Craven said, "the flip side of the story is that we haven't started many world-class companies here" (The Oregonian, Mar. 17). The firms based in other regions rarely expect that the Oregon outposts will replace their headquarters, conducting their entire firms' kernel projects; they will still rely on their headquarters for their core activities, such as R&D and Marketing strategies, and important personnel in both research and management parts. Rather, their main concern will be saving-cost; the firms will focus on how to reduce costs through the process of production, not on how to differentiate their products from other competitors, which will prohibit Oregon from accumulating industrial

[16] Many of the executives in Silicon Valley got to know each other as students at Stanford or as participants in local business and political affairs, and these acquaintances contributed the openness and cooperation among companies (Saxenian, 1994).

[17] A news article describe this phenomenon as "Few tall pines sprout in Oregon's Silicon Forest, but the state turns out to be pretty good at nurturing transplant" (Oregonian, Mar. 17, 2007)

resources for the high-tech industry.[18] Moreover, the other region based firms will leave Oregon when other regions offer better conditions; they will easily replicate Oregon's facilities as they make Oregon facilities using other regions' resources. As long as the high-tech firms in Oregon do not depend on Oregon's resources for differentiation of their products, the superficial development of high-tech industry cannot be an evidence of Oregon's strong competitive advantage for the high-tech industry. The weak relative wages of the Oregon high tech cluster (in table 1) can be explained in this context; the workers are given wages as rewards not for their creative jobs but for relatively standardized jobs by their head quarters.

2. FOREST CLUSTER

(1) The Overview of the Forest Cluster

The forest industry has a long history in Oregon since 1827 when the first sawmill was built (Brown, 2001). The industry has grown to be identified as the second biggest industry cluster in Oregon following the high-tech/software cluster in Cortright and Impressa Consulting's research (2003). According to table 2, in 2005 the forest cluster employs over 60 thousand workers and pays $2.5 billion to the workers, which represents 4.6% of total private sector employment and 5% of total private sector payrolls in Oregon.[19]

A study by E.D. Hovee & Company (2004, Aug.) divides the forest sector into four groups, such as primary products, secondary products, forestry services, and the rest of the

[18] Porter (1991) said that when a multinational firm comes to a developing country, making the country a major center for producing sophisticated component or for conducting core R&D is rarely the multinational company's concern. He added that a developing strategy based on foreign multinational might doom a nation to remaining a factor-driven economy, and that the multinational can relocate when factor costs shift or if wages get too high. As this paper specified in chapter 2, Porter's discussions are applied not only at a national level but also city, region, or state levels.

[19] The actual economic contribution of the forest cluster will be bigger than the numbers illustrated here because the table 2 does not include the data that are unavailable.

Table 2. Forest Cluster's Wage, Employment, and Concentration Analysis ('01~'05)

NAICS, Name	'05 Establishment	'05 Average Wage	'05 Employment	'05 Payroll ($1,000)	'05 Relative Wage	'01~'05 Relative Growth	' L.Q. in 2005
Primary							
321113 Sawmills	119	45,902	8,606	395,018	29%	5%	6.34
32121 Veneer, Plywood, and Engineered Wood Product Manufacturing	118	40,329	11,023	444,549	10%	-16%	7.20
32211 Pulp Mills	1	ND	ND	ND	NC	NC	ND
32212 Paper Mills	9	66,201	2,520	166,848	3%	21%	2.09
32213 Paperboard Mills	6	ND	ND	ND	ND	NC	ND
Subtotal			**22,149**	**1,006,415**			
Secondary							
32191 Millwork	143	32,351	8,663	280,252	-6%	-2%	4.35
32192 Wood Container and Pallet Manufacturing	44	24,619	671	16,523	-5%	41%	0.93
32199 All Other Wood Product Manufacturing	81	34,014	3,136	106,655	2%	13%	2.48
32221 Paperboard Container Manufacturing	16	48,942	1,023	50,056	8%	6%	0.45
32222 Paper Bag and Coated and Treated Paper Manufacturing	18	43,314	938	40,622	-6%	9%	1.00
32223 Stationery Product Manufacturing	2	ND	ND	ND	NC	NC	ND
32229 Other Converted Paper Product Manufacturing	2	ND	ND	ND	ND	NC	ND
33711 Wood Kitchen Cabinet and Countertop Manufacturing	325	30,545	4,203	128,378	-5%	24%	1.97
33712 Household and Institutional Furniture Manufacturing	84	27,282	1,764	48,115	-9%	11%	0.67
337211 Wood Office Furniture Manufacturing	15	ND	ND	ND	NC	NC	ND
337212 Custom Architectural Woodwork and Millwork Manufacturing	14	33,863	295	9,973	-18%	NC	1.36
Subtotal			**20,693**	**680,574**			
Service							
11311 Timber Tract Operations	47	58,794	286	16,815	13%	-12%	6.09
11321 Forest Nurseries and Gathering of Forest Products	10	24,965	116	2,894	6%	-11%	3.55
11331 Logging	845	38,950	7,520	292,923	23%	9%	9.25
11531 Support Activities for Forestry	323	26,186	3,976	104,103	-10%	6%	20.47

321114 Wood Preservation	17	38,607	548	21,153	4%	36%	3.85
33321 Sawmill and Woodworking Machinery Manufacturing	38	ND	ND	ND	NC	NC	ND
333291 Paper Industry Machinery Manufacturing	9	ND	ND	ND	NC	NC	ND
42321 Furniture Merchant Wholesalers	31	49,663	193	9,593	3%	-25%	0.34
42331 Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers	181	75,341	3,102	233,689	55%	-3%	1.83
42411 Printing and Writing Paper Merchant Wholesalers	13	56,032	423	23,706	-8%	-11%	2.04
42413 Industrial and Personal Service Paper Merchant Wholesalers	47	58,652	504	29,566	6%	4%	0.61
44211 Furniture Stores	390	29,976	3,604	108,038	-4%	7%	0.97
Subtotal			**20,272**	**842,480**			
Total			**63,114**	**2,529,469**			

<Source: Bureau of Labor Statistics, U.S. Department of Labor>
ND: Not Disclosable, data do not meet BLS or State agency disclosure standards
NC: Not Calculable, data do not exist or it is zero
For more detailed information, please see the appendix B.

economy. The primary product group produces goods using logs or other forest harvest commodities as inputs of the industries, such as sawmills, veneer/plywood plants, and pulp and paper mills. The secondary product group includes the manufacturers who produce more refined wood products such as furniture or cabinets. The forestry service group provides support services to primary and secondary firms, such as logging contractors, timber track operators, fire protection, restoration, and ecological services, and research agencies—we can also include wholesalers or retailers in the group, even though this research does not refer to them. The rest of the economy group is public/non-profit sectors that are not directly linked to the forest sectors but have important linkages to the previous three groups in a broad sense.

As of 2005, in Oregon there were 22,149 workers (35% of the total private employees in the forest cluster) receiving wages of $1,006,415,000 (40% of the total private payrolls in the cluster) in the primary group; 20,693 workers (33%) with wages of $680,574,000 (27%) in the secondary product group; and 20,272 workers (32%) in the

service product group with wages of $842,480,000 (33%). (See table 2). These data indicate that the workers in primary product group earn more than those of the secondary product group, while the workers in the service product group earn wages that are comparable to the group workers' ratio in the total workers of the cluster.

(2) Recent Performance Analysis

Table 2 shows the cluster's recent performance. In terms of relative wage, the cluster shows competitiveness in the primary product and forest service groups, but the secondary product group shows weak competitiveness. In the primary product group, all the 3 industries' average wages are slightly higher than the national wages (sawmills: 29%, veneer, plywood, and engineered wood product manufacturing: 10%, and paper mills: 3%). The forest service group also shows a little higher average wages than the national averages: 7 out of 10 industries show higher averages. However, among the 7 industries, only 3 industries show 10% higher average wages than the national averages (logging: 23%, timber tract operations: 13%, lumber, plywood, millwork, and wood panel merchant wholesalers: 55%). However, in the secondary product group, 6 industries' average wages are below the national averages, while 2 industries show higher average wages than the national averages. Moreover, these two industries' average wages are also slightly higher than the nation's (all other wood products manufacturing: 2%, paper container manufacturing: 8%). We can conclude that the second product industries are, as a whole, not competitive.

In terms of the relative growth rate, Oregon shows higher employment growth rates in about two thirds of the cluster industries: in 13 industries Oregon shows bigger employment increases (or smaller employment decreases) than the nation averages, while in 7 industries Oregon shows smaller employment increases (or bigger employment decreases) than the national averages.

The L.Q. value shows that Oregon has somewhat high employment concentrations in the cluster, reflecting Oregon's abundant forest industrial resources. In 15 industries the L.Q.s are above 1, while in 6 industries the L.Q.s are below 1.

(3) Oregon as an Environment for the Forest Cluster

The abundant forest volume is the source of this cluster's formation: in 2002, Oregon's forestland size was the third biggest (29.6 million acres) among the 50 states, following Alaska (127.9 million) and California (40.2 million acres). Given the state's land size, Oregon has higher ratio of forestland (48.2%) than the other two states: Alaska (34.7%) and California (40.3%).[20]

However, the abundant forest resource cannot guarantee the forest cluster's competitiveness. M. Porter (1991) says that abundant natural resource is a trap for many developing countries. He attributes Canada's and Australia's weak international positions in sophisticated manufacturing goods to the abundant natural resources. Oregon's weak competitiveness in secondary wood products and competitiveness in primary products can be understood in this context. Oregon seems not to overcome the temptation to depend on the abundant natural resource. Oregon's weak competitiveness in the secondary product industries is a crucial problem to the cluster's economic value creation. Generally speaking, we can say that the firms in the secondary product group have more opportunity to charge high prices for their products based on the quality of the technologies and human creativities that are inputted into the products. Thus, the prices of the primary products, such as lumber or veneer, would not show as big of a difference as the secondary products, such as a table or a bed. For example, the prices of the ash lumber in U.S. show little difference nationwide from $656/m on the low end to $1613/m on high end despite the quality difference: the highest price is only 2.5 times of the lowest (Mar. 14, 2007). [21] However, the price difference among secondary products, such as a desk or a bed, is much larger than the ash lumber's prices. The price difference will be as large as the difference of consumers' wealth.

In terms of location, Oregon has competitive advantages. Oregon's close location to Canada, Japan, and China, who import forest products from the U.S. more than any other

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[20] Source: Brad Smith et al. (2004)'s research.

[21] Source: http://www.virtuallumber.com/index.html

countries[22], provides competitive advantages to the cluster. The closeness to California and other southwest states can also be a competitive advantage (E.D. Hovee & Company, 2004, June)[23]. Oregon has a good accessibility to major international ports, such as Portland, Seattle, and San Francisco, which is a great advantage for the forest product industries that usually produce big products, such as logs, ply, and furniture.

Oregon's unusual interest in environment and sustainability causes burden for the regional firms. Oregon is the first state that enacted comprehensive forest practices rules and regulations in 1971: The Forest Practice Act, which still set standards for ensuring forest reforestation and wildlife protection both on public and private lands. Oregon lost only 8% of its forestland since European visited it about 400 years ago (Oregon Forest Resource Institute).

However, Oregon's interest in environment and sustainability could be a competitive advantage in the long term. Today, consumers who are aware of the environment throughout the world are asking firms to be more earth-friendly. This trend is reflected in the certification system, such as the Forest Stewardship Council (FSC) and the Sustainable Forest Initiative (SFI), in the forest industry. The certification can reward companies that produce their products in more environment friendly ways. At the moment, there is not consensus among the forest stakeholders about whether the certification will better position Oregon products in the market (E.D. Hovee & Company, 2004, June). However, considering consumers' support for the ethical companies today, Oregon's image and practices of sustainability will provide better competitive advantages to the forest clusters. The Home Depot, the biggest wood product retailer in the U.S., increased the sale

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[22] As of 2006, Japan, Canada, and China are the major import countries for the U.S.'s forest products: the total values of export to Canada, Japan, and China are $2,185,897,000 $724,588,000, and $547,247 respectively. (Source: http://www.fas.usda.gov/ustrade/)

[23] In an interview conducted by E.D. Hovee & Companies (See, E.D. Hovee & Company (2004, June)), Oregon forest stakeholders see Oregon's proximity to domestic markets of the U.S. Southwest (notably California, Arizona, Texas) as well as the Far East as its competitive advantage.

of FSC-certified wood products from $15 million in 1999 to $250 million in 2002 in response to a consumer campaign (Costanzo, 2003, May-June)

Environmental issues have also decreased Oregon's timber harvest from federal lands sharply since 1990. The U.S. Fish and Wildlife Service listed the northern spotted owl as a threatened species in 1990, and added other species as threatened species afterwards, which decreased Oregon's timber harvest rapidly from federal lands (Brandt et al., 2006). The Pacific Coast area had experienced radical increase in reservation areas from the early 1990s (Smith et al., 2004). This caused a log supply shortage, increasing the prices of log as well as secondary and value-added products (Perez-Garcia et al., 2005). The result of the harvest decrease also affected Oregon local communities that are dependent on timber harvest (Brown, 2001). However, this change could bring positive effects on the Oregon forest cluster in the long term. As the increased prices of wood fiber made the wood saving technologies become advantages: Engineered wood products gained market share (Perez-Garcia et al., 2005), the increase in the prices of raw materials will motivate the cluster industries to shift their interests to cost-saving technologies or producing high value products, which will eventually increase the cluster' competitiveness.

3. FOOD PROCESSING AND AGRICULTURE CLUSTER

(1) The Overview of the Food Processing and Agriculture Cluster

The food processing and agriculture cluster is one of the clusters that exist throughout the state and affect the whole state. Thus, the competitiveness of the clusters is important to the workers' incomes, especially the workers in rural communities. The cluster employs about 99,135 workers and pays about $2,572,233,000 for their wages, which is respectively 7.1% of the total private workers and 5% of the total private workers' wages in Oregon (see table 3), These numbers illustrate that the workers in the cluster earn less than other workers in Oregon.

This paper divides the cluster into three groups by the nature of the products: primary, secondary, and related product groups. The primary group produces the raw

Table 3. Food Processing and Agriculture Cluster's Wage, Employment, and Concentration Analysis ('01~'05)

NAICS, Name	'05 Establishments	'05 Average Wage	'05 Employment	'05 Payroll ($1,000)	'05 Relative Wage	'01~'05 Relative Growth	L.Q. in 2005
Primary							
11114_Wheat Farming	43	22,083	230	5,072	4%	-43%	4.33
11115_Corn Farming	1	ND	ND	ND	NC	NC	ND
11119_Other Grain Farming	53	21,114	53	1116	-28%	25%	0.43
11121_Vegetable and Melon Farming	168	21,460	2,741	58,828	1%	-8%	2.22
11133_Noncitrus Fruit, Tree Nut Farming	390	14,767	7,246	106,999	-18%	-3%	3.75
11141_Food Crops Grown Under Cover	376	21,824	376	8,215	-17%	-49%	1.40
11199_All Other Crop Farming	358	21,311	3,874	82,561	-4%	35%	6.80
112111_Beef Cattle Ranching and Farming	151	21,857	777	16,985	-11%	0%	2.05
112112_Cattle Feedlots	9	28,781	170	4,902	-5%	-3%	0.91
11212_Dairy Cattle and Milk Production	100	26,523	1,355	35,950	11%	21%	1.43
11221_Hog and Pig Farming	2	ND	ND	ND	NC	NC	ND
11231_Chicken Egg Production	4	35,327	244	8,634	31%	-15%	1.33
11232_Broilers, and Other Meat Type Chicken Production	2	ND	ND	ND	NC	NC	ND
11233_Turkey Production	ND	ND	ND	ND	NC	NC	NC
11234_Poultry Hatcheries	5	27,484	67	1,844	-9%	12%	0.56
11239_Other Poultry Production	1	ND	ND	ND	NC	NC	ND
11241_Sheep Farming	6	ND	ND	ND	NC	NC	ND
11242_Goat Farming	ND	ND	ND	ND	NC	NC	NC
11251_Animal Aquaculture	11	20,938	86	1,802	-24%	18%	1.17
11291_Apiculture	8	24,488	40	977	-8%	93%	2.11
11411_Fishing	130	46,121	254	11,715	-20%	-13%	2.87
11421_Hunting and Trapping	3	12,618	6	77	-42%	31%	0.24
Subtotal			**17,519**	**345,677**			
Secondary							
31111_Animal Food Manufacturing	21	41,344	271	11,222	-8%	-8%	0.45
31121_Flour Milling, Malt Manufacturing	6	46,694	303	14,148	5%	30%	1.31
31122_Starch and Vegetable Fats and Oils Manufacturing	5	ND	ND	ND	NC	NC	ND

31123_Breakfast Cereal Manufacturing	2	ND	ND	ND	NC	NC	ND
31131_Sugar Manufacturing	1	ND	ND	ND	NC	NC	ND
31132_Chocolate and Confectionery Manufacturing from Cacao Beans	2	ND	ND	ND	NC	NC	ND
31133_Confectionery Manufacturing from Purchased Chocolate	23	15,632	251	3,920	-53%	18%	0.54
31134_Nonchocolate Confectionery Manufacturing	9	20,488	114	2,341	-48%	110%	0.52
31141_Frozen Food Manufacturing	32	26,388	6,065	160,046	-22%	0%	5.42
31142_Fruit and Vegetable Canning, Pickling, and Drying	46	30,932	2,933	90,711	-22%	19%	2.67
31151_Dairy Product (except Frozen) Manufacturing	19	39,880	1,866	74,433	-11%	9%	1.36
31152_Ice Cream and Frozen Dessert Manufacturing	9	37,415	302	11,290	-6%	34%	1.08
31161_Animal Slaughtering, Processing	55	29,746	1,557	46,328	3%	-23%	0.25
31171_Seafood Product Preparation and Packaging	25	22,619	1,029	23,275	-29%	5%	1.97
31181_Bread, and Bakery Product Manufacturing	156	27,740	2,991	82,972	-7%	9%	1.14
31182_Cookie, Cracker, and Pasta Manufacturing	22	43,355	837	36,303	14%	-6%	1.21
31183_Tortilla Manufacturing	5	24,744	219	5,429	-4%	42%	1.06
31191_Snack Food Manufacturing	11	35,282	435	15,362	-12%	-34%	0.77
31192_Coffee and Tea Manufacturing	23	41,068	533	21,896	-8%	9%	3.10
31193_Flavoring Syrup and Concentrate Manufacturing	1	ND	ND	ND	NC	NC	ND
31194_Seasoning and Dressing Manufacturing	12	ND	ND	ND	NC	NC	ND
31199_All Other Food Manufacturing	43	30,185	1,178	35,568	-37%	88%	1.63
31211_Soft Drink and Ice Manufacturing	8	41,115	330	13,578	-2%	-37%	0.66
31212_Breweries	12	ND	ND	ND	NC	NC	ND
31213_Wineries	114	23,058	1,402	32,331	-45%	35%	3.33
Subtotal			**22,616**	**681,153**			
Related							
11511_Support Activities for Crop Production	223	18,661	4,459	83,208	-4%	15%	1.27
11521_Support Activities for Animal Production	84	17,822	230	4,105	-35%	24%	0.69
333111_Farm Machinery and Equipment Manufacturing	40	40,223	580	23,322	-13%	NC	0.78

42382_Farm and Garden Machinery and Equipment Merchant Wholesalers	122	40,492	1,487	60,205	2%	-5%	1.18
42441_General Line Grocery Merchant Wholesalers	28	49,688	3,114	154,709	8%	-7%	1.16
42442_Packaged Frozen Food Merchant Wholesalers	22	33,953	524	17,777	-24%	63%	1.40
42443_Dairy Product (except Dried or Canned) Merchant Wholesalers	17	ND	ND	ND	NC	NC	ND
42444_Poultry and Poultry Product Merchant Wholesalers	2	ND	ND	ND	NC	NC	ND
42445_Confectionery Merchant Wholesalers	35	44,357	467	20,733	0%	4%	0.75
42446_Fish, and Seafood Merchant Wholesalers	17	37,666	369	13,889	-4%	NC	1.32
42447_Meat and Meat Product Merchant Wholesalers	29	41,243	396	16,336	-2%	16%	0.87
42448_Fresh Fruit and Vegetable Merchant Wholesalers	70	29,810	2,160	64,374	-23%	13%	2.29
42449_Other Grocery and Related Products Merchant Wholesalers	201	38,656	3,287	127,052	-11%	-8%	1.22
42451_Grain and Field Bean Merchant Wholesalers	19	83,608	165	13,795	95%	-12%	0.31
42452_Livestock Merchant Wholesalers	11	9,284	195	1,810	-25%	-10%	0.74
42459_Other Farm Product Raw Material Merchant Wholesalers	5	32,077	65	2,069	-27%	64%	0.57
42481_Beer, Ale Merchant Wholesalers	41	38,363	1,910	73,280	-13%	16%	1.75
42482_Wine and Distilled Alcoholic Beverage Merchant Wholesalers	25	42,124	399	16,825	-33%	-12%	0.55
42491_Farm Supplies Merchant Wholesalers	258	33,404	2,982	99,603	-16%	12%	2.20
44511Supermarkets and Other Grocery (except Convenience) Stores	615	22,401	28,036	628,020	10%	6%	0.98
44512_Convenience Stores	660	14,227	3,773	53,678	-9%	-2%	2.11
44521_Meat Markets	50	18,258	311	5,672	-13%	5%	0.50
44522_Fish and Seafood Markets	31	15,224	182	2,771	-31%	31%	1.06
44523_Fruit and Vegetable Markets	39	22,109	239	5,291	-12%	-33%	0.44
44529_Other Specialty Food Stores	313	15,011	2,808	42,158	-31%	3%	1.69
44531_Beer, Wine, and Liquor Stores	182	17,097	861	14,721	-20%	1%	0.50
Subtotal			**58,999**	**1,545,403**			
Total			**99,134**	**2,572,233**			

<Source: Bureau of Labor Statistics, U.S. Department of Labor>
ND: Not Disclosable, data do not meet BLS or State agency disclosure standards
NC: Not Calculable, data do not exist or it is zero
For more detailed information, please see the appendix C.

materials, which includes crop farming (such as grain, vegetable, and fruit), livestock farming (such as beef, pig, sheep, and goat), fishing products (such as salmon, mussel, and crab), and even hunting. The secondary group includes the manufacturers who add more value to the primary products through food processing activities, such as milled flour, dairy products, frozen food, and wine. The related product group includes diverse activities from farming machinery manufacturers and research institutes to wholesalers and grocery retailers.

Table 3 shows that the primary group employs 17,519 workers (17.7% of the cluster's total private workers), paying $345,677,000 to the workers (13.4% of the cluster's total private payrolls). The secondary group employs 22,616 workers (22.8%), paying $681,153,000 to the workers (26.5%). The related product group hires more than half of the clusters, 58,999 workers (59.5%), paying $1,545,403,000 to the workers (60%). These data indicate that the workers in primary product group earn less than those of the secondary products group, while the workers in the related product group earn wages that are comparable to the group workers' ratio in the total workers of the cluster.

(2) Recent Performance Analysis

Judging from the relative wages in table 3, the cluster does not seem to be competitive in all three groups. In the primary product group, only 4 out of 15 industries pay higher average wages than the national averages. Moreover, the four industries' average wages are slightly higher than the national averages (wheat farming: 3%, vegetable and melon farming: 1%, dairy cattle and milk production: 12%, and chicken and egg production: 32%). All the other 11 industries in the group pay lower average wages than the national averages. The secondary product group is a little worse than the primary product group. Only 3 out of 18 industries pay higher average wages than the national averages, and they are slightly higher than the national averages (flour milling and malt manufacturing 5%, animal slaughtering and processing: 3%, and cookie, cracker, and pasta manufacturing 14%). All the other 15 industries in the group pay smaller average wages than the national averages. The situation in the related product group is not different from

the primary and secondary groups. Only 4 out of 24 industries pay higher average wages than the national averages, and they are slightly higher than the national averages (farm and garden machinery and equipment wholesalers: 2%, general line grocery merchant wholesalers: 8%, confectionery: 0.16%, grain and field bean merchant wholesalers: 95%, and supermarket and other grocery stores: 10%). The other 19 industries in the group pay lower averages wages than the national averages.

In terms of the relative employment growth rate, the primary group shows a little low employment growth rates, whereas the secondary and related product groups show a little high employment growth rates. In the primary group 7 industries show higher employment growth rates the than national averages, while 9 industries show lower employment growth rates than national averages. In the secondary product groups 13 industries show higher employment growth rates than national averages, while only 5 industries show lower employment growth rates than national averages. In the related industries, 14 industries show higher employment growth rates than the national averages, while 8 industries show lower employment growth rates than the national averages.

The L.Q. indicator shows that Oregon has a high employment concentration in primary and secondary groups, while it does not show a significant concentration in the related product group. In the primary product group 11 industries's L.Q.s are above 1, while 4 industries' L.Q.s are below 1. In the secondary product group, 12 industries' L.Q.s are above 1, while 5 industries show L.Q.s that are below 1. In the related product group, the industries that are above and below 1 are 12 respectively.

(3) Oregon as an Environment for the Food Processing and Agriculture Cluster

Oregon seems to enjoy a few competitive advantages. First, Oregon has a relatively large amount of farmland. Oregon's farmland size is 17,080,422 acres, which is 17th among all states in the U.S.[24] Oregon' farmland size per capita is 4.62 acres, which is much bigger

[24] Source: 2002 Census of Agriculture, USDA

than the national average of 3.13 acres.[25] Oregon's relatively large amount of farmland has enabled Oregon agricultural industries to prosper traditionally. For the food processing manufacturers, Oregon's location is an important competitive advantage. Including Oregon, the Northwest area has played an important role in the U.S. food processing industries. For 100 years, cargo ships have traveled from its ports to all parts of the world with food processed in the Northwest area (Oregon State and City of Portland, 2006). The fact that Oregon is one of the three states that are located on West Coast is also a good condition for the fishing industries and the seafood processing industries.

However, the cluster seems to be suffering from diverse disadvantages. The major reason is that when most producers and processors have to compete in price, Oregon is not the lowest cost production region. "It's not Oregon agriculture's pattern or practices to produce the lowest cost anything," said assistant director Dalton Hobbs in Oregon Department of Agriculture (ODA) (SEDCOR, 2006, May).

Oregon Department of Agriculture (ODA)'s report, *The State of Agriculture* (2007), describes recent trends that pressure regional producers and processors. First, there are huge food demands that are more concerned with price than health. According to the report, the fast-food breakfast market had increased by 22 percent (from $25 billion in 2001 to $30.6 billion in 2005), the to-go food consumption also had increased from 19 meals per person in 1985 to 32 meals today, while the number of meals eaten at a restaurant had decreased from 93 per person in 1985 to 80 meals today, and US consumers are still spending one-third of their food budget for pure enjoyment, not for nutritional value. When consumers care less about their health while consuming foods, they will probably care more about their money. Second, the increased bargaining power of several national food retailers pressures the regional food producers and processors. According to the report, at

[25] Source: (1) farmland size: 2002 Census of Agriculture, USDA, (2) Population: US Census Bureau

the moment only six food retailers[26] control nearly half of all food sales in the U.S, and they are purchasing the least expensive products from all over the world. Third, the report shows that U.S' producers and processors have to compete with international competitors, such as Chile, Mexico, and China, who enjoy lower labor costs than the U.S.: A USDA study finds that the daily wage for eight hours of farm work in Mexico was about $3.60 in US currency, while the U.S. wage was $66.32 in October 2000.

The recent trends described above force Oregon regional producers and processors to cut costs in order to compete in the market. However, Oregon's situation is not favorable for cutting costs. Oregon has the second highest minimum wage of $7.80 per hour among all the 50 states,[27] which is not a good condition for the cluster's industries that depend more on unskilled workers than any other industry. Second, Oregon's small average farmland size of 427 acres (which is below than the U.S. average of 441 acres) is not a good condition when several retailers dominate the half of the food market. That is because the purchasers of raw farm products increasingly demand large quantities of each item and it is more cost-effective for their purchasing departments to meet regional or nationwide demand through one large producer than by sourcing from small, local producers across the country (Mamen 2007). Oregon's relatively large amount of farmland forces the regional producers and processors to export much of their products: more than 80 percent of Oregon's agriculture production leaves the state (over $3.8 billion in raw product and processed food products), with about half of that going overseas ($1.8 billion) (ODA, 2007). However, the severe competition in the international market is not a favorable condition for Oregon producers and processors who are not price-competitive.[28]

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[26]In 2004, by sales the largest supermarkets in the grocery store industry are: Wal-Mart, Kroger, Costco, Albertsons, Safeway, Ahold USA , Supervalu, Publix, Delhaize America , Meijer, H.E. Butt, A&P (Retail Grocery Industry and UFCW: http://www.reapinc.org)

[27] Washington State has the highest minimum wage of $7.93. Source: U.S. Department of Labor (http://www.dol.gov/esa/minwage/ america.htm#Oregon).

[28] The price sensitivity in the agricultural production trade was well illustrated by a sharp decrease in wheat export: with the gain in dollar value, the wheat export decreased from $270 million in 1997 to $97 million 1999.

In the food cluster industries, there are also opportunities for producers and processors to charge high prices for their products through providing more innovative products, such as functional foods (e.g. probiotics, vitamin and mineral supplements, and whole-grain foods) and foods based on consumers' preference (e.g., wheat free food and dairy free food). However, Oregon's weak research universities will not be able to provide good conditions for the development of these industries. Moreover, even though there is rapidly growing demand for organic foods which outstripped the supply (ODA, 2007), Oregon's high labor costs will act as an unfavorable condition for the Organic food industries' growth.

4. SUMMARY OF THE ANALYSIS

(1) The Results of Quantitative Analysis

Through the quantitative method, this research finds the three clusters' recent economic performances. The research finds that all of the three clusters (high-tech, forest, and food processing and agriculture) are not competitive when their average wages are compared with their competitors' averages wages: in the high tech cluster only 1 industry's average wage is bigger than the national averages, while 10 industries' average wages are smaller than the national averages; in the forest cluster 12 industries show higher average wages, while 9 industries show lower average wages (even though 12 industries in the cluster show higher average wages, the industries whose average wages are higher than the national averages by 10% are only 5); and in the food processing and agriculture cluster 12 industries show higher average wages, while 45 industries show lower average wages.

In terms of relative growth rate, each cluster does not show generally higher employment growth rate throughout the three clusters: in the high tech cluster 6 industries' employment growth rates are higher than the national averages, while 5 industries' employment growth rates are lower than the national averages; in the forest clusters 13 industries show higher rates, while 7 industries lower rates; and in food processing and agriculture cluster 33 industries show higher rates, while 23 industries show lower rates.

With regard to the L.Q. indicator, the forest cluster and food processing and agriculture cluster show a generally higher employment concentration, while the high-tech cluster shows a lower employment concentration: in the high tech cluster 4 industries' L.Q.s are above 1, while 7 industries' L.Q.s are below 1; in the forest cluster 15 industries' L.Q.s are above 1, while 6 industries' L.Q.s are below 1; and in food processing and agriculture cluster 35 industries' L.Q. are above 1, while 21 industries' L.Q.s are below 1.

In short, the three clusters show low competitiveness in terms of the relative wage, whereas they show high competitiveness in terms of employment growth rates and L.Q.s.

(2) The Results of Qualitative Analysis

The qualitative analysis illustrates each cluster' competitive advantages and disadvantages. For the high-tech cluster, favorable living conditions, relatively low living costs, and the proximity to Silicon Valley are competitive advantages, while the weak research resources are critical disadvantages for the cluster. The forest cluster also has diverse advantages, such as abundant resources and closeness to the market and international ports, and disadvantages, such as Oregon's emphasis on the environment and sustainability. The food processing and agriculture cluster seems to be dominated by diverse disadvantages at the moment. The cluster has been experiencing pressures coming from every direction, such as Oregon's relatively small market, complicated regulations, and intensified competitions from international competitors who have more favorable conditions. However, the research illustrates that competitive advantages and disadvantages are not fixed; disadvantages can be transformed into competitive advantages, and vise versa. For example, in the forest cluster, the emphasis on the environment and sustainability will make regional firms easily respond to the demands of consumers who are more concerned about the environment, while abundant forest resources motivate regional firms to depend on the abundant resources rather than to differentiate their products through innovation. In high tech cluster, the low living costs is a competitive advantage to attract high tech clusters, but the low living costs in Oregon will attract the firms who are more concerned about saving money in Oregon, not the firms who want to innovate their products by using

Oregon's innovation resources.

(3) Conclusions

This paper finds that the three clusters are competitive in terms of employment growth and employment concentration rates. However, it also finds that the three clusters are not competitive in terms of relative wages. These contradictory conclusions show Oregon firms' strategies for competing in the market at the moment: the regional firms depend more on the cheap inputs, such as abundant natural resources, cheap labor, and cheap land, for their competitiveness source than the innovative technologies, which indicates that the competitiveness of Oregon clusters at the moment can be easily lost by the advents of new competitors who can produce the same products with lower costs. [29]

[29] The firms based on the "low cost" strategy have to compete with numerous competitors who can also easily get the unskilled workers and natural resources: unskilled workers are abundant in most areas, and natural resources are losing their importance because of low transition costs. Thus, the competitiveness of firms based on the "low cost" will not last for a long time. However, firms' competitiveness is based on "differentiation" that is supported by regional uniqueness, the competitiveness will last for a long time.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

1. SUMMARY

In chapter 1, this paper describes the Cluster Initiative's recent popularity as well as Oregon's efforts to develop its economy through cluster approaches. This paper shows the Oregon trade sector industry's competitiveness as a proxy for Oregon clusters' competitiveness, using a state government's report, the *'2007 Competitive Index.'* The report illustrates that the Oregon trade sector do not have high competitiveness compared with other states in the U.S. Chapter 2 introduces the theoretical backgrounds of the cluster, which provides a framework to analyze Oregon clusters' competitive advantages and disadvantages. Relying mainly on Porter's theory, the paper finds answers to the two questions: "why do firms want to locate themselves near other firms (in most cases, their competitors) in limited areas?" and "why do a region have a prominence in only a few kinds of industries that that are connected by commonalities and complementarities?" In the previous chapter (chapter 3), this paper illustrates Oregon's three clusters' competitiveness using quantitative methods, and analyzes each clusters competitive advantages and disadvantages

2. CONCLUSIONS AND POLICY RECOMMENDATIONS

The paper finds that the firms in the three Oregon clusters depend more on cheap resources for their competitiveness than innovative technologies, and that their competitive positions will not last for a long time, as long as the competitiveness is based more on cheap resources than innovative technologies. Oregon needs to provide a business environment where its regional firms can choose "differentiation" as their main competitive strategy. Oregon needs an environment that promotes competition and innovation among the regional firms. The following suggestions will contribute to building the environment.

(1) Supporting Regional Research Universities and Institutes

The generally weak competitiveness in terms of the relative average wage—especially in the manufacturing industries— indicates that the Oregon firms do not rely on innovative technologies for their main competitive strategies. This is not irrelevant to the weak research base. To make Oregon firms more competitive, regional universities' and research institutions' collaborations with regional firms are important. Porter (1991) said that there is no distinction between 'low-tech' and 'high-tech' industries because any industry can be a high-tech industry when innovation is applied to it. Universities and research institutes are at the core of industries' innovation. They provide regional firms with skilled workers, state-of-the-art technologies, and creative ideas, all of which can enable firms to improve their products or save their costs. The Oregon Wood Innovation Center at Oregon State University (OSU), the Food Innovation Center at OSU, the Oregon Nanoscience and Microtechnologies Institute (ONAMI), and the Office of Technology Transfer (OTT) at University of Oregon (UO) is the research institute that helps firms commercialize new technologies (e.g., OTT prepares a list of technologies that were invented by UO and can be commercialized by regional firms in order to transfer the technologies to regional firms. OTT is also focused on protecting UO's intellectual property as well as knowledge transference.) In order to have competitive regional firms, Oregon must have competitive research bases. Oregon needs to support regional universities endeavors to become strong research foundations to the regional firms. Oregon should make its regional universities look attractive for both faculty and students in order to recruit and retain highly qualified faculty and prominent students.

(2) Using Regulations as Tools to Make Competitive Advantages in Oregon

Regulation power is still a major government tool to influence business activities. The developed communication technology and low costs of transferring business inputs, such as natural resources, cannot deteriorate regional governments' power because a firm's competitiveness is based on nontransferable factors, such as regional universities, sophisticated regional consumers' demand, and advanced component product suppliers.

Governmental regulations are not unnecessary red tapes. Rather, the governmental regulations can increase regional firms' competitiveness if government policies promote competition among regional firms rather than protecting them from competition coming from new companies or out of state companies. For example, the recent Oregon State Legislature's movement[30] to regulate the overuse of the 'noncompete agreement' among employers and employees will contribute to the efficient use of regional human resources as well as promoting new start-ups in the region. If Oregon keeps making regulations that promote competition among regional firms, the regulation will increase the competitiveness of the regional firms.

(3) Establishing the Best Living Conditions

Acquiring creative workers who promote innovations in the Oregon industry must be one of the most important priorities in the government policy. As this paper described before, for the creative workers who are needed for high tech industry, the open society that respects and guarantees their diverse ideas and ways of life is the most important factor when the workers find their jobs. Tim Boyle, the CEO of the Columbia Sportswear, pointed out Oregon's poor public schools and crime-threatened environment as critical factors that hinder businesses from recruiting talented employees (Boyle, 2007, Jan. 10). Oregon needs to make itself an attractive place in all aspects: Strong public services in diverse areas, such as public education, public safety, health, social service, protecting environment, need to be established; necessary amenities for people's comfortable living, such as restaurants, shopping centers, hospitals, etc., must be provided for the residents; and dirty and unsafe downtowns must be transformed into places where people enjoy diverse services with their neighbors. Without providing the best living conditions to regional firms, no region will be able to develop a strong regional economy based on competitive regional firms.

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[30] Two bills in the Oregon Legislature -- Senate Bill 248 and House Bill 2257 -- aim to void noncomplete clauses under some circumstances, including when a worker gets laid off (Source: http://lawprofessors.typepad.com/laborprof_blog/2007/03/noncompete_legi.html).

(4) Providing Sophisticated Demands, Using Governmental Procurement

Oregon State Government and other county and city governments can work as sophisticated demanders who can support firms that make products in a desirable way. For example, if public agencies must purchase wood products that have a certification at least a certain percentage of their total purchase when they purchase office appliances, the efforts of producers who are more concerned about forest protection and the environment will be rewarded in the market. If there is a subsidy that promotes regional schools' consumption of foods that acquired FDA or USDA certifications, regional firms that endeavor to produce a safe food in an environmentally friendly way will be rewarded. These governmental supports of desirable products will develop sophisticated demands, which, in return, will contribute to developing more sophisticated products in regional firms. Regional governments need to figure out ways to develop sophisticated demands throughout the industries.

(5) Letting the Market Decide Fitting Industries for Oregon

As this paper described before, there are 31 clusters in Oregon. Oregon cannot have competitive firms in all these clusters because Oregon's unique conditions are favorable only to limited industries. We need to support industries that can develop in the unique business environment of Oregon. However, governments should not decide which industries match with Oregon; the market should decide the suitable industries for Oregon because the market knows well which industries fit Oregon's situation. If there are industries that have been traditionally abundant in the region, industries contribute to a substantial portion of regional income at the moment, and industries have recently showed a substantial growth, Oregon must have some conditions favorable to the industries. The government's support should focus on these industries.

Portland's recent decision to support biofuels need to be reviewed in this context. Portland mandated all diesel fuel sold in the city to contain a minimum blend of 5%

biodiesel, and all gasoline sold in the city to contain a minimum blend of 10%.[31] The city expects that the mandate will bring significant investment to the region, creating jobs and putting Oregon in a position to become a national leader in the alternative fuels industry (Document of Office of Public Safety, Portland City) However, in the market, there is no consensus that ethanol and biodiesel are viable alternative energies.[32] Moreover, biofuel is not the only alternative energy. Given the present situation, there is no proof that Oregon has favorable conditions for the biofuel industry.[33] The city's support for biofuels will mean unfair intervention in the market to those who are developing other alternative energies, such as hydrogen, geothermal, and solar energy.

3. RECOMMENDATIONS FOR FURTHER RESEARCH

As business resources are being transferred to other regions more easily, the resources that are unique to specific regions and that cannot be transferred to other regions have become more important in deciding regional firms' competitiveness. In other words, the industries that match regional characteristics and rely on regional uniqueness as a source of competitiveness have become more competitive in the global competition. To increase regional firms' competitiveness in Oregon, the understanding of Oregon as a business environment is needed to set up proper regional development initiatives. However, recent research about the Oregon cluster has mainly relied on statistical approaches. These statistical approaches have limitations in supply in-depth information on Oregon that can be used in making regional development initiatives. This research is one of the emerging endeavors to understand Oregon from the cluster perspective. However, this research is not

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[31] The mandate is effective from July 1st, 2007.

[32] Pimentel and Patzek (2005) insist that ethanol and biodiesel consume more fossil energy input than the energy outcome they produce.

[33] At the moment, most of the basic elements of biodiesel come from out of state, and there is only one small biodiesel plant in Salem (Griffin, 2007, April 21), and two ethanol plants are expected to be built by 2008. Oregon's total farmland size is 17,080,422 acres, which is 17th among all the states and below the states' average of 18,765,581 in the U.S. (Source: 2002 Census of Agriculture)

satisfactory. My lack of understanding Oregon as a foreigner prevented me from analyzing Oregon from diverse aspects. Studying three clusters at the same time also prevented me from producing enough analysis results for each cluster. I believe that separate research for each cluster by researchers with ample understanding of Oregon will provide diverse and abundant analysis results. The accumulation of the researches' results will provide necessary information for making policies that aim at developing Oregon industries from the cluster perspective.

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