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국제학석사 학위논문

The Study of Maritime Clusters in Japan
Analyzed by the Location Quotient (LQ) Method

일본해사산업에 관한 연구
- 산업클러스터 특화분석을 중심으로 -

2017년 2월

서울대학교 국제대학원

국제학과 국제지역학전공

마 영 준

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이 논문을 국제학석사 학위논문으로 제출함

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마영준의 석사 학위논문을 인준함

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Abstract

This paper aims to delve deeply into the situations in Seto Inland Sea, Japan surrounding maritime industries and the level of clusters. Not only just figure out the existence and the level of clusters in the region, this study predicts on the notion that the level of clusters has a tendency of constant changes for some reasons through specific period. Accordingly, the author tries to grasp the causes of changes in terms of individual corporates. Correspondingly, this study establishes an empirical analysis on whether the region has been clustered or not by applying the Location Quotient(LQ) Analysis Method. At the same time, it has been put much importance on understanding the changes as time passes from the early 2000`s to the early 2010`s. As a result, the LQ index of the three prefectures (Ehime, Hiroshima, Hyogo) along Seto Inland Sea in core maritime industries are all above 1.25. Additionally, they hired more than 0.2% of regional labor force in both periods. Given this result, it is possible to say that there is the existence of industrial clusters in the region. When it comes to the changes of the level of clusters, Ehime, which is the most developing area in the past 10 years outpaced Hiroshima with regard to the LQ index. Furthermore, the clustering in shipbuilding sector has rapidly enhanced compared to the other sectors,

contributing the clustering of a whole maritime industry.

The author's aim is to provide a new perspective to cluster theory by defining the causes on the changes on clusters as a leading company's performance. As a consequence, Imabari Shipbuilding, locating its headquarter in Ehime has played a major role with its distinguished growth in a decade in boosting the level of clusters in Ehime, whereas Tsuneish Shipbuilding in Hiroshima and Kawasaki Heavy Industries in Hyogo with gradual slump were not enough to affect the level of clusters in the region in a positive way.

In addition, it is essential that each prefecture introduce newly customized policies on maritime industry since the level of clustering on each industry has changed respectively and independently. Based on a fact that Japan will be significantly influenced by the flow of trade liberalization, one of the national strategy for structural reform, there is a high level of chance of foreign capital and institutions' influx in a significant way on peripheral industries supporting the core maritime industries. In that way, Japan need to be prepare for maintaining its domestic competitiveness with close interaction in internal clusters based on competition and cooperation.

In fact, it has been continuously predicted as weakening level of the clusters' positive effects due to the enlargement of global supply chain in the world economy. Geographical factors, however, has maintained its importance

on regional industries with clusters. Since the quantity of goods transported is expected to decrease from the world economy's recession that provokes the stagnation of maritime industries including shipping and shipbuilding, it is desperately necessary to support and reinforce the regional clusters that leads up the internal competitiveness against external impacts on regional industries.

**Keyword: Clusters, Maritime Industry, Shipbuilding, Shipping, Harbor
Transport, LQ method, Seto Inland Sea**

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I. Introduction

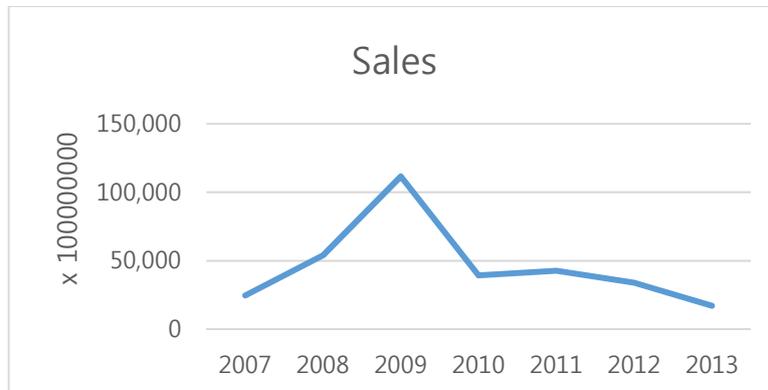
The role of local industry in pursuing national industry development has significantly enhanced on a huge scale. Many industrially advanced countries have implemented industrial cluster policies for economic development not only at the local level, but the government level. Japan, for the same reason, has put much importance on industry cluster policies. However, the academic studies on the necessities and effects of maritime clusters for Japanese maritime industry, which is one of the key industry regarding the nation's geographical characteristics have been conducted little even though many companies involved in clusters are making a huge profit owing to the significant advantages of industrial clusters. As Japanese government has greatly perceived the growing importance of economic revitalization and reinvigoration of local economies since 1990 followed by the lost 20 years, it is desperately in need of policy-making in maritime industry as a whole rather than as an individual industry for each. In this paper, I contribute to the ongoing conversation in effects of clusters in Japanese maritime industry mostly focusing on Seto Inland Sea, which could lead to the enhancement its competitiveness in the region and world. Furthermore, the author will clarify the correlation between a leading company in the region and the industrial competitiveness based on clusters. To assess the factors that facilitate the level of clusters and its effects, this study analyzes the existence of

industry clusters based on 4 prefectures (Ehime, Kanagawa, Hyogo, Hiroshima)
by an empirical study.

II. Background

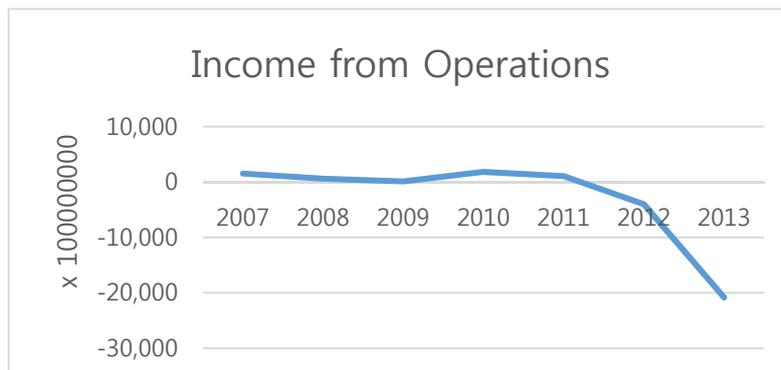
In the era of globalization, it is true that the meaning of regional conglomeration has been weakened by supply chain at the level of global.

For instance, STX, one of the largest shipbuilding company in the past 10 years in Korea, has put much importance on promoting international division of labor. In 2004, it had completed a shipbuilding process only on the ground with Skid Launching System. Right before the financial crisis in 2007, a significantly large investment of \$34 million into Dalian, China in order to produce engine parts which are in the later part of shipbuilding had been finally made by a strategy in terms of global supply chain management. However, this decision was criticized after the financial had broken out. Not only in China, STX had invested aggressively into 8 countries in Europe including France, Finland to reinforce the business sectors in cruise ship and special vessel. In the inefficiency in international division of shipbuilding process with gradually reduced demand in the world, STX had no choice but to be confronted with massive deficit.



Graph 1. Sales of STX, 2007~2013

(Source: DART Data Analysis, Retrieval and Transfer System)



Graph 2. Income from Operations of STX, 2007~2013

(Source: DART Data Analysis, Retrieval and Transfer System)

These graphs indicate that both sales and income from operations from 2009 to 2013 had sharply decreased. This story will be representative case that global division in production in the globalization is not able to be the perfect solution in specific industries.

2.1. Literature Review

Many attempts have been made to define and analyze a cluster phenomenon and clusters are differently defined by era and scholars. Enright and Ffowcs-Williams (2000) argue that clusters are generally created in natural. The conception of clusters was initially coined by Alfred Marshall (1870) through empirical studies on 10 countries facilitating the open-debate with regard to clusters, followed by numerous studies and it has been defined in various. Meanwhile, the importance of economic geography, the core concept of clusters was seriously brought up by Paul Krugman. In his study on Increasing Returns and Economic Geography (1991), he had focused on the neglect of the role of economic geography and regional factors as dimensionless points under international trade theory in tradition. Rather, in a deep understanding of the significance of economic geography, he suggested a reconsideration of economic geography with theoretically designed model in order to heave up the formal factors in this area. Furthermore, he pointed out that the location of demand does not creates itself without manufacturing conditions, mainly on distribution. One of the most influential and confined studies on clusters was done by Porter (1998). He defined clusters as geographic concentrations of interconnected companies and institutions in a particular field and also highlighted that clusters promote both competition and cooperation. Competition can coexist with cooperation

because they occur on different dimensions and among different players. He has made an effort to describe a cluster phenomenon by using Diamond Framework designed by himself.

(2012) focused on more specific clusters, which is Japanese bio-clusters and introduced research direction of industrial cluster's development based on interview research. (2006) considered an industrial cluster to be outbreak source of national innovation to secure competitive advantage of a country and discussed the possibility that bring out a lot of innovations by the strategic formation of industrial clusters. Feser, E. J. (2001) argues that regional clusters are concentrations of business that co-locate because of trading (buyer-supplier) relationships and/or to share common factor markets (including infrastructure, knowledge resources, and labor) and/or common goods market. He also discussed in Feser, E. J. (2009) why development practitioners often associate clusters and cluster analysis with the making of development strategy.

2.1.1 The Definition of Cluster

So as to define cluster, this paper aimed at reviewing previous research done by M. Porter, the most renowned scholar with expertise in clusters, defining it as a cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and

complementarities.¹ He redefined the role of location under the global economy; Location becomes one of the most important factors on competition and strategy at the business level and competitiveness at the level of nations and states as well. He emphasized on the importance of regional concentration as follow;

Competitive industries are not scattered helter-skelter throughout the economy but are usually linked together through vertical (buyer-seller) or horizontal (common customers, technology, channels) relationships. Nor are clusters usually scattered physically; they tend to be concentrated geographically.²

Furthermore, as mentioned above, he had made an attempt to connect national competitive advantage with clusters.

¹ "ON COMPETITION" – M. Porter (1998) p199.

² The Competitive Advantage of Nations – M. Porter (1990) p86.

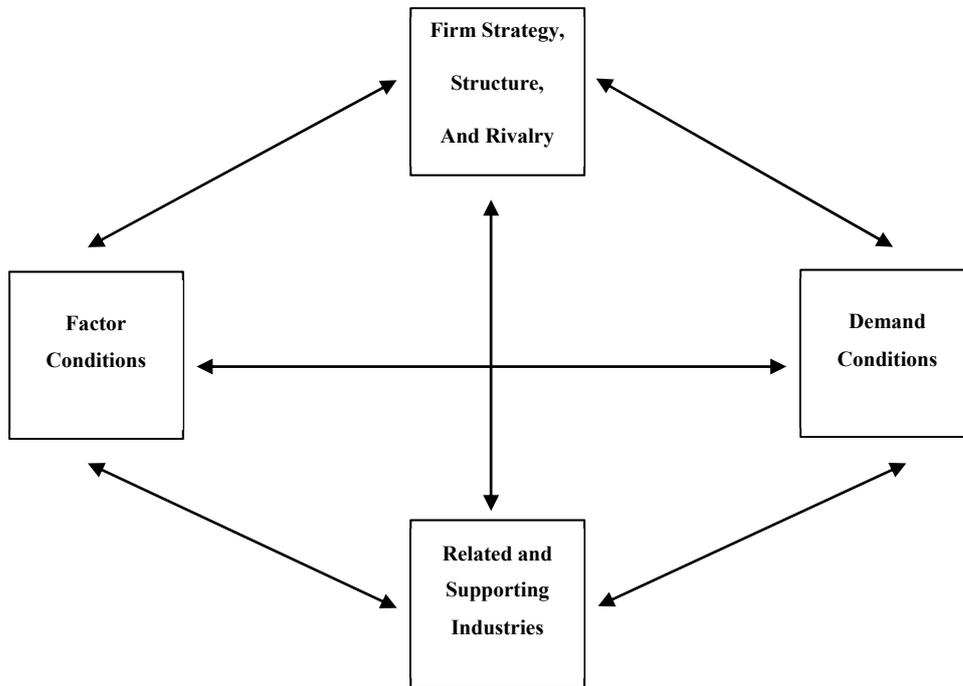


Figure 1. Determinants of National Competitive Advantage

In his research, *The Competitive Advantage of Nations* (1990), he established 4 factors that determining national competitive advantage;

1. *Firm Strategy, Structure, and Rivalry.* The conditions in the nation governing how companies are created, organized, and managed, as well as the nature of domestic rivalry.

2. *Demand Conditions.* The nature of home-market demand for the industry`s product or service.

3. *Related and Supporting Industries.* The presence or absence in the nation of supplier industries and other related industries that are internationally competitive.

4. *Factor Conditions.* The nation`s position in factors of production, such as skilled labor or infrastructure, necessary to compete in a given industry.³

Basically, the competitive advantage in clusters are, at the same time, created by 4 determinants above since M. Porter considers geographical integration in regional industries as one of the national competitive advantage. As clusters are based on the concept of proximity, regional agglomeration of natural resources, human resources, capital, social infrastructure with significant level of concentration tends to make better competitive advantage of clusters. In the case of firm strategy, structure, and rivalry, companies in the same cluster need to substantially compete with each other, which is a catalyst to boost the level of competitiveness up, while M. Porter simultaneously highlighted that clusters promote both competition and cooperation. In other words, clusters are described as repetitively continuous phenomenon of competition and cooperation. Meanwhile, in the era of international division of labor, a large portion of companies have developed their business with others under the name of partners. For instance, shipbuilding company does not necessarily manufacture engine part

³ The Competitive Advantage of Nations – M. Porter (1990) p.78

in order to load on ship for completion. It is no doubt that there must be several engine manufacturers in the proximity so that shipbuilding company can easily procure necessary part with a partnership access and guarantee a variety of resources only into its main shipbuilding process such as painting and design. Likewise, business organization has gradually established strategic relations with others as a service provider, distributor, supplier in the business process. When analyzing competitive advantage of clusters, there is no question of being successful clusters without supportive organizations and actors. Lastly, demand conditions. In the benefit of international trade in globalized economy, the demand for service or product can be created elsewhere in the world, notwithstanding its enormous portion in the local level. In other words, the necessity for geographical proximity in terms of demand conditions is relatively weaker than any other determinants. For example, a man who lives in Brazil may want to purchase Galaxy smartphone made by Samsung Electronics whose headquarter and plant are located halfway across the world.

Industrial clusters has been largely drawn attention by regional economics in the view of agglomeration economy and introduced to regional

development policy in a lot of countries.⁴ M. Porter described thoroughly on wine cluster in California. It includes all relevant industries in wine-producing from the production and supply of grape to distribution and advertisement.

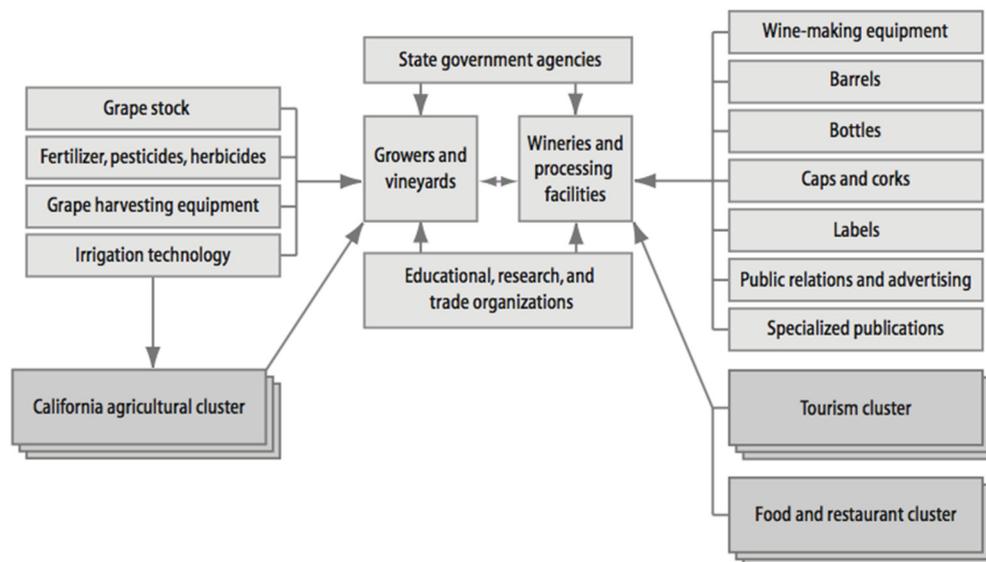


Figure 2. Anatomy of the California Wine Cluster

As analyzed by anatomy of the California wine cluster, not only has each industry connected, other clusters relevant to main cluster with the likelihood of connection link. Tourism cluster, for instance, has interrelationship with California agriculture cluster through the medium of growers and wineries,

⁴ 海事クラスターの歴史分析-日本海事センター (2010) p33.

supported by state government agencies and educational, research, and trade organizations. Namely, industries and clusters may have been involved in a cluster as a whole or not, based on direct or indirect relation with each other. In general, a large number of industries are relevant to clusters. Moreover, there is no clear range when it comes to judge whether an industry is belonged to the cluster or not. It is explained that government in the region or state has the key to design the area of clusters as a policy maker. In other words, the competitiveness of specific industrial clusters may change significantly by organizer's decision-making.

2.2. The Concept of Maritime Clusters

The concept of industrial clusters in maritime industries was firstly introduced by Norway in 1990's in the world. It has been focused for the most part on designing strategic policies to create synergy between related industries such as Shipping and Shipbuilding.

2.2.1 Japanese Maritime Clusters

Before delving into the concept of maritime clusters, it is desperately in need of giving an explanation of maritime industry.

Maritime industry primarily refers to industries whose activities are created by seaborne trade. In general, several industries belong to maritime industry have something to do with the directness on maritime business, which

means that each has to create profit and maintain business in the ocean. Representatively, shipping leads the whole relevant industries since it is directly linked with the demand creation in trade. At the same time, it encompasses shipbuilding, harbor transport, classification, harbor management, repair and maintenance of ships and etc. As mentioned above, however, governments with aspiration on the competitiveness in maritime industry are paying attention to control the industry not as an individually separated one, but as a whole complex.

According to the report on the status of Japanese Shipping by Ministry of Transport in Japan (2000), maritime clusters are defined as a complex between government, educational institutes and industries including Shipping, Shipbuilding, Harbor Transport, Classification, Finance, Legal Service and relevant industries.⁵

In general, it is classified by 3 classes; First(Core), Second(Semi-Core) and Third(Indirect).

⁵ The report on the status of Japanese Shipping by Ministry of Transport in Japan (2000).



Figure 3. Maritime Industries Grouping

First class represents core maritime industries. They are directly linked with the activities of maritime industry. It refers to the industry that constructs ship and harbor necessary for transporting human and marine cargo, encompassing industries such as shipping, shipbuilding, harbor transport, ship machinery and equipment. Semi-core industries are categorized in the second class. They are somewhat directly relevant to the productive activities in the clusters, rather supporting the first class industries with various services, which are desperately necessary for maritime business, for instance, providing funds or human resources. It includes legal and financial services and educational institutes. In particular, educational institutes such as university and vocational

school are gradually providing labor forces into the maritime industry. Furthermore, there is third class as well. Although much more indirectness with maritime industry itself than first and second class, it has the likelihood of affecting maritime industry since industries belong to third class like marine engineering and fishery are doing economic activities around the ocean.

In addition, since they have a great ripple effect to Japanese economy, it is necessary to be managed thoroughly at the government level in a strategic manner.

2.2.2 European Maritime Clusters

29 countries, members of the EU and most of European countries belong to EEA are engaging in maritime activities and had formulated maritime cluster in each with a gap on scale.⁶ According to the European Commission, maritime industry in Europe has accomplished job creation of 5.4 million people and generated a market in size of 500 billion euro annually. Furthermore, 21 European countries, which accounts for about 20% of ships in the world, are the

⁶ 欧州海事クラスター及び海事関連団体の概況及び今後の戦略等に関する調査 – 日本船用工業会、日本船舶技術研究協会 (2014) p1.

members of European Community Ship-owners Associations.⁷

As mentioned above, Norway is the first country to design maritime cluster policy in the globe. However, it is quite clear that European Commission as a whole has taken the lead in each country's policy. In 2007, EC announced a comprehensive European maritime policy with the concentration on the enforcement of global competitiveness of European maritime clusters and the sustainable development of maritime industry with the protection of environment. In 2013, a new maritime strategy, LeaderSHIP2020, was launched by EC aiming at fostering better relations among the state, people and educational institutes under the form of cooperation. The particular goal is to facilitate sustainable growth and employment of European maritime clusters in the short and mid term with the 4 major axis; 1. Employment and Skills 2. Market Access and the Improvement on the Condition of Competition 3. Financing 4. R&D and Innovation

The most representative case would be Denmark. More than 100,000 people are currently engaging in the maritime industry in Denmark with

⁷ 欧州海事クラスター及び海事関連団体の概況及び今後の戦略等に関する調査 – 日本船用工業会、日本船舶技術研究協会 (2014) p1.

approximately a quarter having joined in shipping industry. It had names its domestic maritime industry as “Blue Denmark” and started a branding of maritime clusters for the first time in Europe in the late-1980`s. Blue Denmark is a maritime cluster with the members having relationships directly and indirectly as well.

	Production (Million DKK)	GDP (Million DKK)	Employment (The Number of Employees)	Export Ratio (%)
Shipping	145,459	17,227	16,243	97%
Shipbuilding	8,350	1,536	3,595	52%
Blue Denmark in Total	302,875	110,296	84,747	85%
Denmark in Total	2,876,057	1,381,275	2,824,702	36%
Percentage(%)	10.5%	8.0%	3.0%	-

Table 1. The Importance of Blue Denmark in Denmark’s Economy

(Source: Danish Maritime Authority)

Among the globe, Norway is the first country to design maritime cluster policy. It has focused on the context whether the two major maritime industries, which are shipping and shipbuilding can cooperate with other industries in order to create

2.3. The Core Japanese Maritime Industries

Japan with insufficient natural resources such as coal, ore, gas has developed its industry by importing raw material and exporting competitive products. Moreover, more than 99% of total export and import trade is processed by marine transportation.

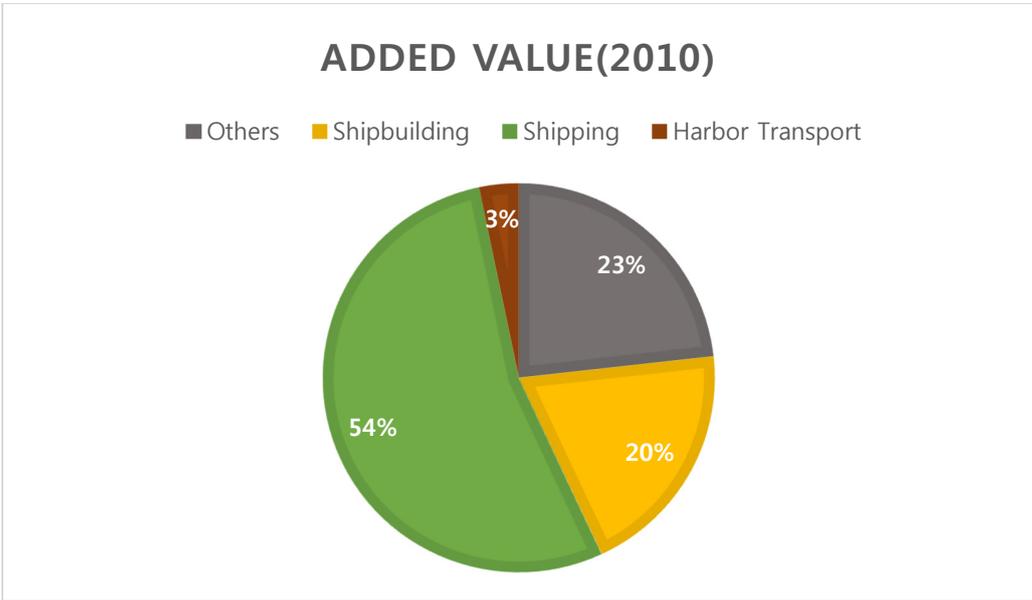
Generally, it is the widely known fact that the demand of shipbuilding is created by the one of shipping. It is very clear that shipping is the most significant industry in the maritime industry that activates the whole related industries in terms of the sequence of supply and demand system. As a rule, shipping industry focuses on meeting the demand of seaborne trade, which is the reason why it is in need of vessels. In natural, shipbuilding industry tries to win shipbuilding contracts with shipping industry. However, it is quiet different on the formation of clusters. By the fact of the nature of industries, manufacturing may take a major role with regard to the agglomeration. Likewise, shipbuilding is the industry manufacturing significant seaborne transportation in the maritime industry.

So as to analyze Japanese maritime clusters, I choose 3 industries; shipbuilding, shipping and harbor transport as key objects of analysis among a variety of industries in Japanese maritime industries based on a fact that they are distinctly linked with each other and highly related to other industries calculated

by an inter-industry relation table at the same time. Besides, they are highly ranked in the scale of added value, sales and the number of employees.

Category Ranking	Added Value (2010) (Unit : Hundred Million Yen)	Sales (2010) (Unit : Hundred Million Yen)	Employees (2009) (Unit : Number)
1	Shipping (22,549,53.71%)	Shipping (57,126,40.24%)	Shipbuilding (103,292,34.35%)
2	Shipbuilding (8,316,19.81%)	Shipbuilding (27.634,19.47%)	Harbor Transport (68,466,22.77%)
3	Harbor Transport (1,359,3.24%)	Harbor Transport (18,414,12.97%)	Shipping (54,285,18.05%)
Total	41,984	141,953	300,679

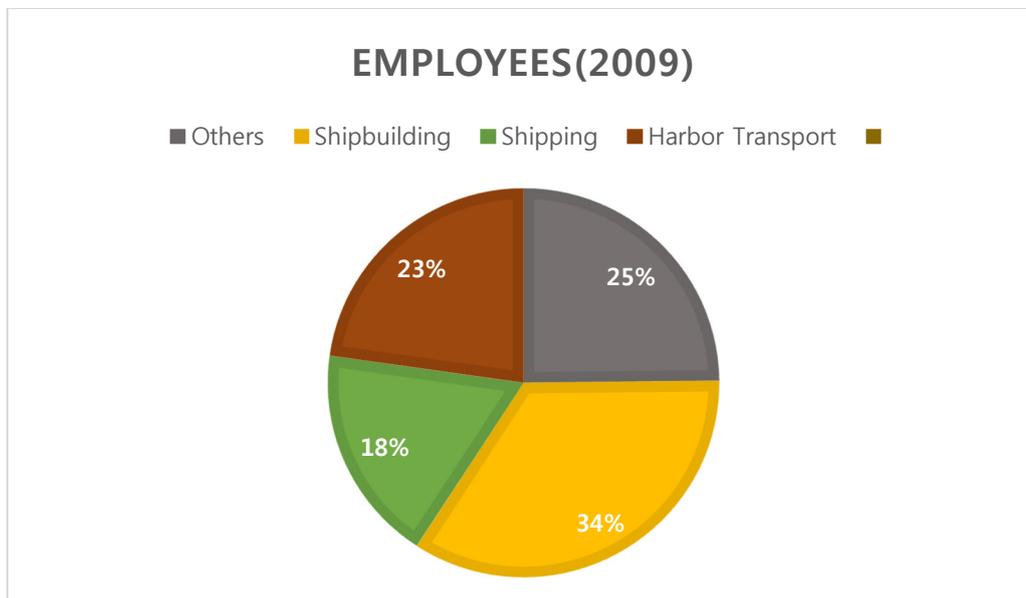
Table 2. The Ranking of Individual Maritime Industries Categorized by Added Value, Sales and Employees



Graph 3. The Share of Industries on Added Value in 2010



Graph 4. The Share of Industries on Sales in 2010



Graph 5. The Share of Industries on Employees in 2009

From now on, this study defines maritime industry as 3 core industries for convenience; Shipbuilding, Shipping and Harbor Transport.

2.3.1 Shipbuilding

In the mid-nineteenth century, England is the first country focusing on shipbuilding industry. By its superior technology and know-how on shipbuilding, it has maintained its shipbuilding competitiveness among developed and developing countries. Since 1950`s, however, it had been outpaced by Japan with most developed technologies including block building method. In 1956, Japan became the no.1 country on shipbuilding industry in the world. Yet, it had had hard time to keep its leading position like England for some reasons. It could be

explained as surplus capacity, strong yen, the decreasing demand for a new ship caused by oil crisis and newly emerging industrial nations such as Korea and China. In brief speaking, shipbuilding with structural recession was not a promising industry at that time. What is unique about Japanese shipbuilding industry is that it had been well-controlled by its government. Japan had successfully carried out a large-scale restructuring and cut its shipbuilding capacity back extensively. Later on, it caused Japan to lose its leading position in shipbuilding industry in 2000`s since Korea and China had aggressively invested into the extension of manufacturing capacity. The emergence of container in seaborne trade, starting from the early-1970`s had contributed new comers to enter shipping industry so easily without having know-hows and technologies. In 1990`s, as a result of a strong yen from Plaza Accord and economic development in Asia, industrial structure had been changed by international specialization, for instance, the acceleration of local production in manufacturing.⁸

2.3.2 Shipping

Traditionally, Japan is well-known for one of the most developed shipping industry in the world. Government has played an active role in

⁸ 海事クラスターの歴史分析-日本海事センター (2010) pp36.

controlling shipping as a nation`s fundamental industry. The system of 6 major companies, made by shipping integration in 1964 became 5 majors and finally 3 primarily major makers in 1999; NYK, MOL and K-Line.

Meanwhile, there is a unique pattern on Japanese shipping industry. Japan had adopted the system of tender of specified contractors on selection of makers in seaborne trade, restraining foreign shipping makers to enter the market and maintaining long-term contract with Japanese shipping makers. In other words, by providing bidding opportunities only to domestic makers, Japanese shipping makers can guarantee its continuous business with domestic shippers. Furthermore, the symbiotic relationship among actors such as shippers, shipping companies, shipbuilding companies and government has successfully established. For instance, shippers provide shipping companies a long-term guarantee on seaborne trade business and shipping makers plans to build new ships based on stable business with little risk. At the same time, shipbuilding makers continuously take order for new shipbuilding projects coming from this symbiotic system. It helps Japanese government to control actors related to marine industry with ease.

2.3.3 Harbor Transportation

Basically, goods carried by ship are loaded and unloaded by harbor transporter at harbor. In the case of unloading, products are transferred to truck

so that they can be smoothly delivered to customers and vice versa. Harbor transporter has a very important role that they are in charge of successful shipping on exportation and importation from start to finish.

Since container system had developed by founder of Sea-Land Service in 1960, the work of loading and unloading at harbor has advanced significantly over 5 decades. In Asia, the remarkable development of rising countries that includes China and India has facilitated seaborne trade more and more. However, the volume of marine transportation, conducted through Japanese harbors has distinctly diminished since Japan had lost its position as a hub by neighboring nations. For example, Kobe has the most active harbor until 1990`s, while it had been overtaken by Busan and Incheon harbor in Korea. In sum, the reinforcement of harbor transport`s competitiveness is definitely necessary in order not to affect negatively on international competitiveness of Japanese industry as a whole.

III. Research Design

3.1. Research Question

The research question is mainly about factors that facilitates maritime cluster. Since many actors involved in the same cluster, the author will clarify the correlation between a leading company in the region and the industrial competitiveness based on clusters. To assess the factors that facilitate the level of clusters and its effects, this study analyzes the existence of industry clusters based on 4 prefectures (Ehime, Kanagawa, Hyogo, Hiroshima) by an empirical study.

3.2. Research Purpose

Before moving on confirming the hypothesis, it is critically necessary to establish the existence of maritime clusters in Seto Inland Sea region by analyzing the level of geographical agglomeration. After determining the existence, this paper tried to look at the level change of cluster in order to establish the specific factors contributing to the result. Mainly, the author analyzed on the statistical data from Statistics Japan.

3.3. Methodology

Methodological tools for clarifying the existence of industrial clusters have not yet been established in a merged way similar to the defining work of that. Besides qualitative assessment mostly based on interview research, there are

some quantitative tools generally used in the study of clusters, for instance, input-output analysis, graph analysis, correspondence analysis, location quotient method and etc.

Department of Trade and Industry (2001) furthered the study of industrial clusters by using LQ (Location Quotient) method. It defined regional clusters as industries which account for at least 0.2 percent of the regional workforce and which are at least 25 percent more concentrated than the average ($LQ > 1.25$). Whereas, Pontus Braunerhjelm and Bo Carlsson (1999) suggested a different view in terms of formation of clusters. They imposed the condition that to be considered the core in a cluster, the industry should have total employment exceeding 1000 and each core industry should constitute a significant share of economic activity in the relevant fields, which is calculated by LQ (Location Quotient) that should be at least 1.3 ($LQ > 1.3$).

As mentioned above, this study examines the level of maritime clusters by using Location Quotient Method under the understanding of agglomeration in clusters. LQ index practically stand for a regional concentration in a specific industry. Meanwhile, it can be interpreted by two ways; The number of workplaces and employees. By using statistical data from Statistics Japan, it concentrates on enhancing the objectivity and reliability of research.

In order to ascertain whether these 4 prefectures are regionally clustered

or not, economic data in the region are analyzed using a Location Quotient(LQ) method which is an analytical tool that measures a region's industrial specialization relative to a larger geographic unit (usually the nation). LQ index is computed as an industry's share of a regional total for some economic statistic (the number of workplace and employees) divided by the industry's share of the national total for the same statistics as below;

LQ index (Workpalces) =

$$\frac{\text{(The Number of Workplaces in the Regional Industry/The Number of Total Workplaces in the Region)}}{\text{(The Number of Workplaces in the State Industry/The Number of Total Workplaces in the State)}}$$

Equation 1. LQ index on Workplaces

LQ index (Employment) =

$$\frac{\text{(The Number of Employees in the Regional Industry/The Number of Total Wokrplaces in the Region)}}{\text{(The Number of Employees in the State Industry/The Number of Total Employees in the State)}}$$

Equation 2. LQ index on Employment

- 1) $LQ > 1$; Area has proportionally more workers employed in a specific industry sector than the larger comparison area
- 2) $LQ \geq 1.25$; Area industry has potential to be classified as exporter
- 3) $LQ < 1$; May indicate opportunity to develop businesses in the local area

(Source: The Board of Trade, UK)

Not only 3 prefectures along Seto Inland Sea were analyzed, a specific region with its powerful maritime industries away from Seto area is going to be a case analysis object, which is Kanagawa near Tokyo in order to compare the level of clusters with Seto Inland Sea and others.

The Seto Inland Sea (瀬戸内 , Setonaikai) lies between the Japanese main islands of Honshu, Shikoku and Kyushu. Its calm waters stretch over 400 kilometers from Osaka to Kitakyushu and include some 3000 islands, many of which are inhabited. The Seto Inland Sea's mild climate and its islands' relaxed atmosphere invite comparisons with the Mediterranean Sea. Most of the sea is part of the Setonaikai National Park, one of the first national parks designated in Japan.⁹

The area is geographically surrounded by three parts; western Honshu, Kyushu and Shikoku. It is also shared by 6 prefectures; Ehime, Kagawa, Hiroshima, Okayama, Hyogo and Yamaguchi.

With its fluent resources created by seaside locations, it is said that many of maritime industries have flourished naturally and were supported by

⁹ <http://www.Japan-guide.com>

government as well.

Among 43 prefectures, some regions along Seto Inland Sea are well-known for its developed industries regarding maritime industries. It can be explained by locational characteristic. Historically, the area alongside Seto Inland Sea has been flourished with its abundant resources largely came from sea. Shipping on the sea has been particularly developed to take an important role in terms of export and import in Japan.

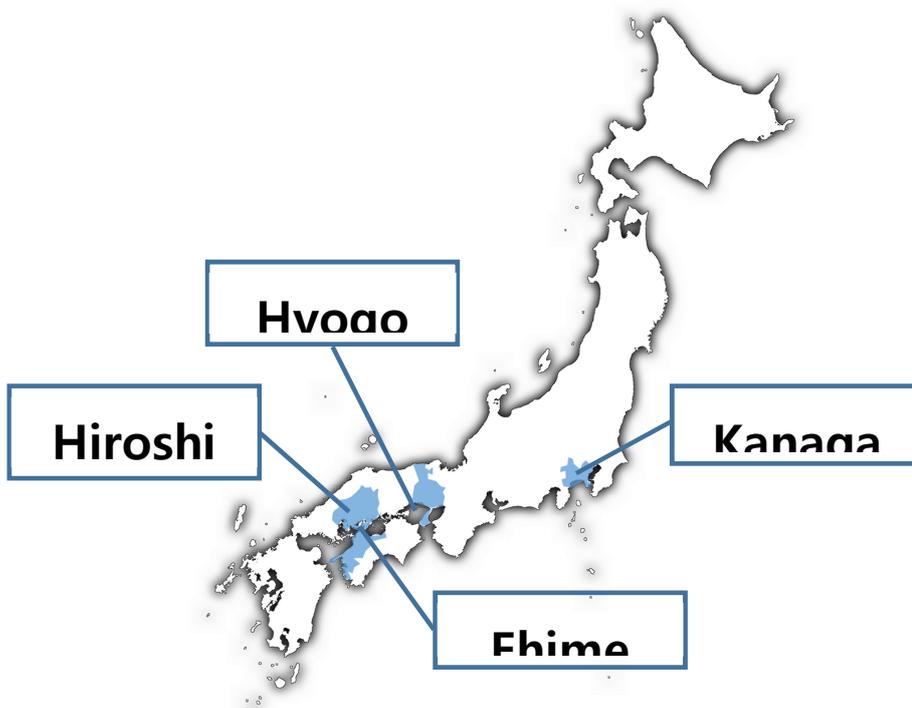


Figure 4. The Core Regions of Japanese Maritime Clusters

This research sets the time period of about 10 years from 2001 and 2012 for some reasons. First, Japan had had hard time of economic recession for 10 years. It had lost the lead in terms of industrial competitiveness including maritime industry. In the economic downturn at domestic level, there happened an enormous economic depression in the globe in 2008. As one of the most industrially developed nation, Japan

IV. Analysis

4.1. The Ratio of Regional Labor Force in Maritime Clusters

In the previous research from Department of Trade and Industry (2001), there is a prerequisite to judge the existence of clusters in the region, which is the ratio of employees in specific cluster. To say that clusters exist, industries belong to the same cluster must employ more than 0.2% of regional labor force.

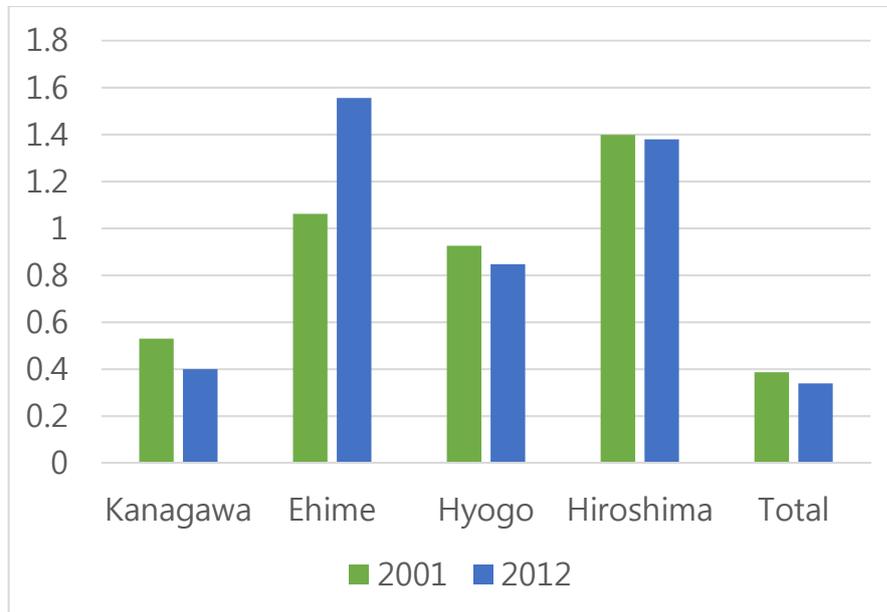
Total	Kanagawa	Ehime	Hyogo	Hiroshima
0.38684624	0.52982014	1.061341575	0.92530023	1.39814236

Table 3. The Ratio of Employees in Maritime Clusters in the Region, 2001

Total	Kanagawa	Ehime	Hyogo	Hiroshima
0.339464864	0.399378178	1.555501997	0.846800276	1.379226785

Table 4. The Ratio of Employees in Maritime Clusters in the Region, 2012

Fortunately, all regions are satisfied with the condition of regional employment at the level of 0.2%.



Graph 6. The Ratio of Regional Labor Force in Maritime Clusters, 2001 and 2012

The thing is that Ehime shows the highest level of growth with regard to the ratio of regional labor force in maritime cluster, outpacing Hiroshima in approximately 10 years, whereas other regions tended to decrease by a small margin as time passed. In overall, many employees became engaging in maritime industries in Ehime. each prefecture had met the criterion of The Board of Trade in Britain, which is over 0.2% of regional labor force, with regard to the ration of employees in maritime clusters in the region. Yet most of all, Ehime is the only region that augmented its value on the ratio of employees in almost a decade, whereas the ratio had entirely decreased from 2001 to 2012 in other 3 prefectures. It is construed as some reasons affected the employment market in maritime

industry. First, the loss of industrial competitiveness in shipbuilding caused by catch-up nations such as Korea and China. Second, Japan has gradually suffered from economic recession in the global context and domestic depression in the middle of the last 20 years. Because of the decline in port traffic in the world trade volume, shipping industry in Japan had no choice but to be damaged by decreased demand.

4.2. LQ Analysis on Employees in Maritime Clusters

By using Location Quotient (LQ) method, it is able to determine how much a geographically proximate group has accomplished clustering phenomenon. It defined regional clusters as industries which are at least 25 percent more concentrated than the average ($LQ > 1.25$).

Total	Kanagawa	Ehime	Hyogo	Hiroshima
2.183674215	1.36958845	2.743574749	2.391907	3.61420692

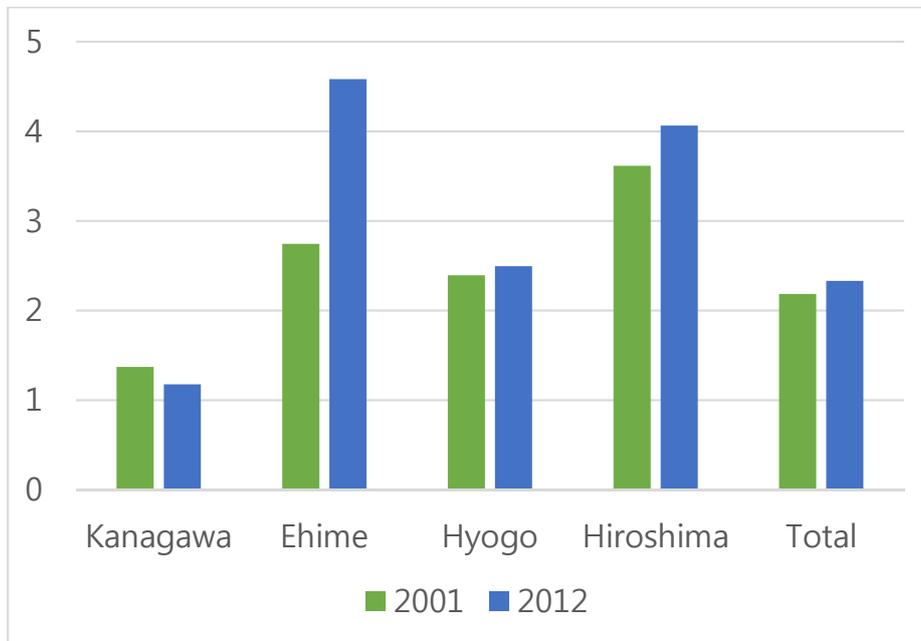
Table 5. LQ Index on Employees, 2001

Total	Kanagawa	Ehime	Hyogo	Hiroshima
2.329940104	1.176493418	4.58221796	2.494515239	4.062944155

Table 6. LQ Index on Employees, 2012

In terms of employees, all prefectures meet the requirements of 1.25 in 2001. Hiroshima took the first place, followed by Ehime, Hyogo and Kanagawa. In 2012, however, Ehime outdid Hiroshima with the gap of 0.5, becoming the

most industrially concentrated region in maritime cluster.



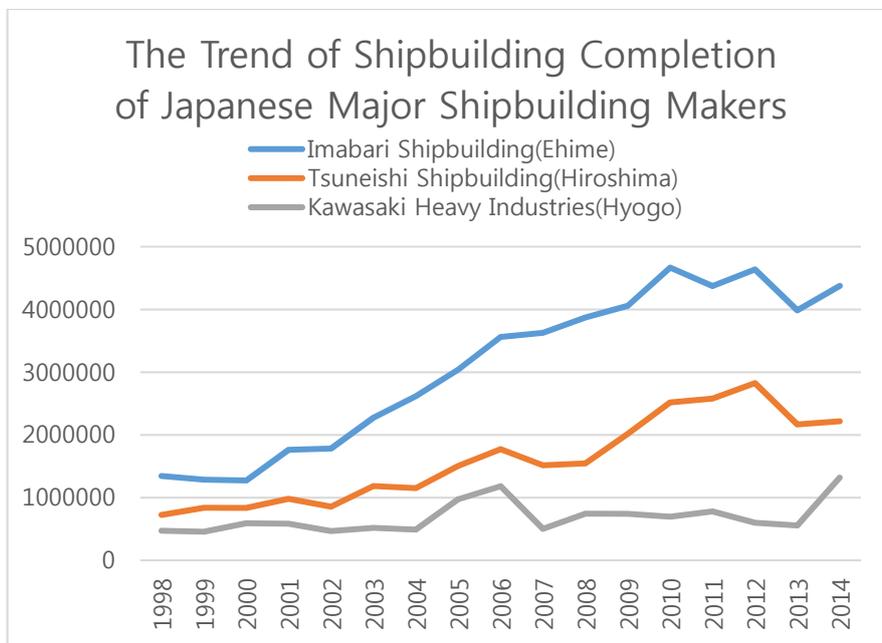
Graph 7. LQ index on Employees, 2001 and 2012

	2001	2012
Shipbuilding	3.283766111	7.197332372
Shipping	5.327789460	4.154671069
Harbor Transport	0.803081274	1.029246876

Table 7. LQ index on Employees, Ehime, 2001 and 2012

Ehime with the most outstanding growth in total LQ index can be analyzed by each industrial sector; Shipbuilding, Shipping and Harbor Transport.

In the case of shipbuilding, it had increased by more than twice in about 10 years. It clearly indicates that the region has significantly agglomerated at the level of 5 times the basic cluster level of 1.25. With the decline in shipping and incline in harbor transport by a small margin, it is obviously true that shipping had led the regional cluster level as a whole.



Graph 8. The Trend of Shipbuilding Completion of Japanese Major Shipbuilding Makers
(Source: KP DATA, IHS)

In addition, it could be argued that there are some factors leading the level of specific industrial concentration. A leading company as an innovator in the cluster may concentrate employment and business in the region.

The graph above is the trend of shipbuilding completion in Japanese major shipbuilding makers. There are some representative shipbuilding makers whose headquarters and main production site locating in the region, alongside Seto Inland Sea. In Ehime, Imabari Shipbuilding has made remarkable development with its strong capacity. It had increased from 1 million to 4 million tons in new shipbuilding completion, whereas the other makers in Hiroshima and Hyogo; Tsuneish Shipbuilding and Kawasaki Heavy Industries augmented its output only at the level of 2 million tons and 0 respectively.

	2001	2012
Shipbuilding	5.452356	6.798305312
Shipping	4.173195	2.502134587
Harbor Transport	0.985665	0.959112102

Table 8. LQ index on Employees, Hiroshima, 2001 and 2012

At the same time, Hiroshima, ranked at number one in shipbuilding in 2001 tend to slightly reinforce the level of clusters. However, as mentioned above, it had fallen spots to the second place in 10 years, caused by Ehime`s outstanding growth in maritime cluster. Yet, still Hiroshima is one of the most concentrated area in maritime cluster in Japan with the level of about 6.8. Meanwhile, the level

of regional specialization in shipping had been diminished by half in a decade. It can be possibly argued that the stagnation of the volume in seaborne trade in and out had negatively affected the overall decline in Japanese shipping sector with its comparative advantage from geographical merits.

	2001	2012
Shipbuilding	2.046453	2.399529742
Shipping	2.321268	1.224284041
Harbor Transport	2.869293	3.33076576

Table 9. LQ index on Employees, Hyogo, 2001 and 2012

Similarly, Hyogo had experienced its decline in shipping by half, whereas others increased narrowly.

	2001	2012
Shipbuilding	1.239717	0.902194563
Shipping	0.458899	0.569828322
Harbor Transport	1.975800	1.907510920

Table 10. LQ index on Employees, Kanagawa, 2001 and 2012

Based on the criterion of the Board of Trade in Britain, the LQ index in

terms of employees in 2001 is above 1.25 both respectively and totally. However, it is clearly analyzed that the one in Kanagawa in 2012 had dropped below 1.25, whereas other prefectures are maintaining its industrial competitiveness in local industries.

In overall, ranking among 4 prefectures is slightly changed, that is, from 2001 to 2012. In 2001, Hiroshima took the first place, followed by Ehime, Hyogo and Kanagawa. Yet, the position of the first place had been reversed by Ehime in 2012, which means Ehime has become the most agglomerated region in Japanese maritime clusters.

4.3. LQ Analysis on Workplaces in Maritime Clusters

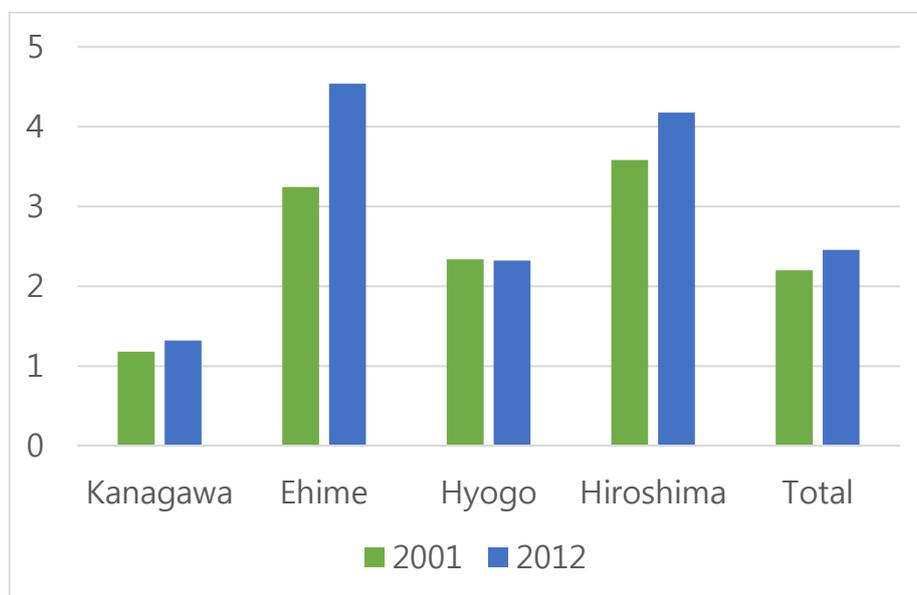
The change of LQ index between 2001 and 2012 with regard to workplaces has shown similar pattern with the result of employees. Hiroshima ranked first in 2001 in terms of regional concentration on workplaces, followed by Ehime, Hyogo and Kanagawa with gradual gap.

Total	Kanagawa	Ehime	Hyogo	Hiroshima
2.19933147	1.17977381	3.243366778	2.33798072	3.58226222

Table 11. LQ Index on workplaces, 2001

Total	Kanagawa	Ehime	Hyogo	Hiroshima
2.455248466	1.319733213	4.538171397	2.321439521	4.176115265

Table 12. LQ Index on workplaces, 2012



Graph 9. LQ index on Workplaces, 2001 and 2012

	2001	2012
Shipbuilding	3.443010583	6.149145971
Shipping	4.763269851	4.839994842
Harbor Transport	0.726683883	1.023425998

Table 13. LQ index on Workplaces, Ehime, 2001 and 2012

When analyzing industry by industry, Ehime has grown the most among the regions in overall LQ index on workplaces from 3.2 to 4.5. In particular, workplaces in shipbuilding sector had outstandingly converged by

twice. It is estimated that the remarkable increase of shipbuilding in Ehime could contribute the region to outpace Hiroshima in terms of the regional concentration in maritime cluster.

	2001	2012
Shipbuilding	4.001695751	6.067633942
Shipping	4.589568885	3.291621930
Harbor Transport	1.296226864	1.315447371

Table 14. LQ index on Workplaces, Hiroshima, 2001 and 2012

It is analyzed that the significant fall of regional convergence of workplaces in shipping is the main reason behind its change of leading position in Seto Inland Sea even with the strengthened concentration in shipbuilding.

	2001	2012
Shipbuilding	2.018235897	1.980947107
Shipping	2.396288502	2.172289246
Harbor Transport	2.946274329	3.151546003

Table 15. LQ index on Workplaces, Hyogo, 2001 and 2012

Hyogo fortunately fulfilled the requirements of cluster in all maritime

industries, while it had shown, to some extent, decrease apart from harbor transport.

	2001	2012
Shipbuilding	0.782326096	0.878791449
Shipping	0.316766158	0.611197817
Harbor Transport	3.220349554	2.921462495

Table 16. LQ index on Workplaces, Kanagawa, 2001 and 2012

Except for harbor transport, it is clearly evaluated that there is no existence of cluster in both shipbuilding and shipping in Kanagawa. The noticeable point is that LQ index in shipping had doubled in the situation that other core regions of Japanese shipping have not had any upward growth and even fallen with regard to regional concentration of workplaces.

However, LQ index on workplaces in maritime cluster had increased by a narrow range in about 10 years, whereas the one on employees had rather decreased in the same period.

4.4. Policy Implications

Ehime recorded increase on both the number of workplaces and employees in shipbuilding in a decade. When it comes to the number of employees per workplace, however, Ehime had 17 employees per workplace in 2001, on the other hand, 23 employees in 2012. It is analyzed as an enlargement of single shipbuilding workplace, which would be the result of gradual growth in business and promoting increase of investment in facilities.

On the contrary, shipbuilding had converged in Hiroshima. Reportedly, Hiroshima had diminished its workplace's scale from 27.9 to 25.6 employees, which represents as a unit of small-scale company. It is estimated that being small businesses in shipbuilding, with susceptibility to economy of scale has a tendency of weakening the competitive edge, at the same time, resulting in decreased competitiveness of industrial cluster on the whole. In other words, it is in need of concentrating industrial ability to compete on major companies by the enforcement of policy, focusing on abolishing or combining small and medium sized shipbuilding makers with shortage of competitiveness.

Meanwhile, the number of workplaces and employees in shipping and harbor transport shows decreasing trend in the nation that includes the core maritime clusters because of depression in world economy as well as the decrease of domestic market. It is interpreted that Japanese government should focus on

designing maritime policies that attracts the significant volume of seaborne trade in the globe, overcoming its limitations of domestic market by the improvement of industrial power through enhancing the quality of shipping service and refurbishing its harbors.

4.5. The Impact from the Movement of Free Trade

Among a lot of developed countries in the world, Japan is significantly passive on bilateral and multilateral FTA. Up to mid-to-late 1990`s, it has laid emphasis on commerce strategy based on multilateralism for some reasons. It had been argued that it was quite fatal to Japan over a trade war with U.S. in 1980`s. Moreover, there was a large scale of pressure on the issue of opening agricultural area. On top of that, government officials in trade had a tendency to blindly follow policies from WTO in order not to repeat the same error it had experienced previously.

However, regionalism on trade has been a powerful trend since late 1990`s. It had been arguably caused by a continuous failure of WTO Ministerial Conference, a proliferation of FTA and Asian financial crisis in 1997. Japan participated in earnest in the era of FTA with its first FTA agreement with Singapore in Feb.2002.

Meanwhile, it is apparently observed that Japanese FTA has somewhat different features compared to other countries. Because of its large portion of

domestic demand with 127 million population, the total volume of trade to the regions with which Japan has signed FTAs is relatively too low.(The percentage of trade to the regions signing FTAs to the total is a mere 18.2% in 2013) Additionally, a number of items in the sector of the agriculture, fisheries, livestock has sufficiently liberalized under the name of protectionism.

However, Japan has made such an effort to change its policy direction in terms of trade that it is necessary to follow current FTAs trends to increasingly enlarge its export volume. Representatively, it is concentrating on TPP negotiations to reverse its current situation in East Asia since Korea and China has already dominated regional economic integration. TPP that encompasses 12 countries in trans pacific area is a de facto bilateral FTA between U.S and Japan.

As I mentioned above, clusters are consisted of various actors who are related directly and indirectly to industries. It has a very significant role that It is possibly able to connect each actor from government, company, employees to financial and educational institutes. In the middle of clustering, services which are one of the facilitators to boost the level of clusters are very much essential because it is hard to achieve a successful cluster without the support of indirect service providers that includes finance and legal services.

In the era of liberalization and globalization, the participation of foreign-affiliated service providers in the formation of clusters is resistless situation at

least. Therefore, there is high probability of foreign involvement in the establishment of industrial clusters in Japan as well.

Up to now, Ehime and Hiroshima prefecture as a typically developed region in the maritime industry are entirely demanding on domestic educational institutes to establish cooperation in the context of clusters.

Namely, Hiroshima University had set up a laboratory in the graduate school of engineering about shipping and marine environment. By using 100m length of water tank test, industry-university research with regional shipbuilding companies has been vigorously made. In the case of Ehime, the two main academic institutes, Yuge merchant ship school and Namikata University of Marine Technology, are strenuously supplying many outstanding talents into related industry.¹⁰

As the case of Hitachi Cambridge Laboratory located in Cambridge city, for instance, not only domestic company has participated in the academic-industrial cooperation, Japanese companies are belonged to the cooperation in the R&D field of semiconductor and Nano-technology. Consequently, it means

¹⁰ 各県別海事産業の経済学-愛媛県- - 日本海事センター企画研究部 (2012) p5.

that there is no huddle with regard to the academic-industrial cooperation in the clusters.

Japan, with its defensive attitude toward economic cooperation, is now shifting its ground to focus on preemptive effect by multilateral FTA; TPP. It is rather clear fact that Japan is not able to maintain its position as a defender of national providers' profit. On the contrary, it will be desperately in preparation for a massive influx of foreign-affiliated service providers.

V. Conclusions

5.1. Summary

The role of local industry, which can be led to the development of national industry is becoming more important even with the globalization of world economy. Many industrially advanced countries, including Japan, are striving to keep pace with the growing importance of industrial clusters at the local level by implementing strategic cluster policy.

Maritime industry, one of the major industries in Japan, are composed of various individual industry that are directly or indirectly linked with maritime business. Japan with the understanding of significant benefit from clusters has started its maritime cluster policy in earnest since the early 2000`s. Above all, the regions along Seto Inland Sea has flourished its maritime industry with geographical advantage. The most important thing, however, is to identify the existence of cluster itself by its industrial concentration in the region.

This paper clearly pointed out that 3 prefectures which are Ehime, Hiroshima and Hyogo have formulated maritime clusters with significant evidence of regional agglomeration by using LQ analysis. The Board of Trade in Britain had set up its guideline to judge whether a region is industrially clustered or not. Basically, it applies a standard of LQ index of 1.25 in judging industry

clusters. LQ index of 1.0 in mining represents that the region and the nation are less specialized in the industry; while an LQ of 1.5 means that the region has a higher concentration in the industry than the nation. Simultaneously, it is in essence necessary that relevant industries hire more than 0.2% of regional labor force.

Furthermore, it recognized the level change of maritime clusters in each region over time period of 10 years. Interestingly, it is shown that there is a critical change among 4 prefectures. The main purpose of this research, however, is to find the factors determining the level change of industrial cluster. Moreover, this paper tries to support the hypothesis with more detailed evidence of leading company's outcome in the most significant industry. Through a statistical analysis, a leading company's output had contributed to the level-up of regional clusters with geographical concentration the most. Representative makers are analyzed by its new shipbuilding completion in the same period and the result shows that there is a similar pattern; incline and decline between the output of leading company and the level change of clusters.

Although, this paper contributes to identify the existence of clusters in the region by empirical study and suggest policy directions, it is true that analytical tool had limitations on quantitative research by depending only on LQ index. At the same time, qualitative analysis such as interview research should

be conducted in order to analyze substantive competitiveness of industrial clusters with regard to the relationships among industries and actors. Furthermore, the author failed to establish the correlation between the level of regional concentration and competitiveness of clusters. Since LQ index used by this paper is basically the ratio of comparative agglomeration in the region, it had overlooked the absolute size of specific industry and the scale of regional economy. For instance, it is observed that shipping in Kanagawa exceptionally grew on both workplaces and employees in 2001 and 2012, whereas its regional concentration in the industry is still in short of the level of 1.25, the standard of existing as a cluster.

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논문초록(Abstract in Korean)

The Study of Maritime Clusters in Japan Analyzed by the Location Quotient (LQ) Method

일본해사산업에 관한 연구

- 산업클러스터 특화분석을 중심으로 -

마영준

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국제학과 국제지역학전공

이 논문은 일본의 해사산업에 관련하고 있는 세토내해 지역의 해사 클러스터가 어느정도 군집화 하고 있는지를 깊게 들여다 보는데에 목적을 둔다. 또한, 단순히 해당 지역의 클러스터의 존재와 레벨을 알아 보는 것이 아니라, 클러스터의 정도가 특정 기간에 어떠한 이유들로 인해 지속적으로 변화할 수 있다는 인식에 기반하고 있다. 이에, 저자는 그 시간적 경과를 2000년대초에서 2010년초의 약 10년으로 설정하고 그 변화를 관찰하는데 중점을 둔다. 동시에,

변화의 요인 중 하나를 개별기업의 성과로 가정하고 그 배경을 분석하는데 초점을 맞추고 있다.

따라서, 이 논문은 가장 먼저 해당 지역이 해사산업에 있어 클러스터화 되어 있는지의 여부를 LQ 방법을 중심으로 실증적 분석을 하고 있다. 그 결과, 세토내해에 접하고 있는 중요 해사산업지역인 에히메현, 히로시마현, 효고현은 핵심해사산업에 있어 클러스터 정도를 나타낼 수 있는 LQ지수가 1.25를 넘고 있어 사실상 모두 타 지역에 비해 해당 산업이 클러스터화 되어 있다고 판단한다. 또한, 양 기간 모두 지역노동력의 약 0.2% 이상을 해당산업이 고용함으로써 클러스터 형성 기준을 충족하고 있다. 이로써, 해당지역에 해당산업의 클러스터가 형성되어 있다고 말할 수 있다. 그러나, 시간의 경과에 따른 클러스터 정도의 변화를 살펴보면, 해당 기간 가장 발전한 에히메현의 LQ지수가 10년후 히로시마현을 앞지른다는 것이 관찰되었다. 이와 더불어, 조선업의 클러스터화가 가장 급속하게 진행됨으로써 전체 해사산업을 이끌어 나가는 것 또한 관찰되었다.

앞서 언급된 바와 같이, 저자는 이 변화에 있어 개별기업의

실적이 하나의 요인이 된다는 것을 정의함으로써 클러스터 이론에 새로운 시각을 제공하는 것을 목표로 한다. 그 결과, 히로시마현의 츠네이시 조선, 효고현의 카와사키 중공업의 부진과는 달리, 에히메현에 본사와 조선소를 두고 있는 이마바리 조선이 해당 기간 큰 성장을 기록하면서 해당 현의 클러스터 정도를 끌어 올리는데 큰 역할을 담당하고 있다는 결론을 이끌어 내기에 이르렀다.

또한, 해사산업이라는 큰 범주 안에 위치 하고 있으나 각 현에 있어서의 개별해사산업의 군집정도가 다르게 변화하고 있기 때문에 각 현들은 지역의 산업구조에 맞는 해사산업정책을 도입할 필요가 있을 것이다. 뿐만 아니라, 일본이 경제구조개혁의 주요정책으로 생각하는 무역자유화의 바람이 향후 일본경제에 큰 영향을 줄 것으로 예상되는 바, 해사산업, 특히 중핵적 해사산업을 지원하는 주변적 해사산업에 외국 자본과 기관이 진출해 들어올 가능성이 있으므로 일본국내의 경쟁력을 유지하기 위한 대비책을 철저히 준비해야 할 것이다. 이는 앞서 제시했던 경쟁과 협력을 기반으로 한 클러스터 내부의 긴밀한 상호작용을 바탕으로 해결할 수 있다.

세계경제, 특히 제조업에서의 전방위적인 서플라인 체인의 확대는 지역경제와 산업의 집중도에 따른 클러스터 효과를 약화시킬 것으로 예상되었으나 클러스터가 지역산업발전에 기여하는 다양한 요소로 인해 여전히 지리적인 요소는 그 중요성을 유지하고 있다. 세계경제의 침체로 오는 물동량의 감소로 해운업의 부진, 더 나아가 조선업과 이와 관련한 여러 해사산업의 침체가 예상되므로, 외부적인 영향을 이겨낼 수 있는 즉, 내부적인 경쟁력의 하나인 지역 클러스터를 적극 지원, 강화하여 산업진흥의 토대를 마련해야 할 것이다.

주요어: 클러스터, 해사산업, 조선업, 해운업, 항만운송업, LQ 분석, 세트내해

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