

# Entrepreneurial Networks in Niigata Prefecture in 1897: Measure of Local Milieu

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## **Abstract**

*This research explores the historical emergence, expansion and evolution of entrepreneurial networks in Niigata Prefecture in Japan, indicating the existence of prominent “local milieu”, which led to the creation and activation of regional clusters and centers for industrial growth and collaboration.*

*The emergence and expansion of such clusters was directly and indirectly impacted by the local geography, physical distance and “perceived distance”.*

*This paper illustrates how “perceived distance” influenced the evolution of industrial clusters, as well as the roles played by key local influencers during this time of growth.*

**Keywords:** *cognitive, industrial cluster, leadership, perception, Niigata, Japan*

**JEL classification:** M 120, M 12, M 52, L 83

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## **1. Introduction**

The concept of economic geography is based on the Local Milieu concept (Camagni, 1991). For example, there are regions where management resources are scarce, but economic development is triggered by a certain thing, and there are regions that don't develop, no matter how many management resources are available. What makes this difference is Local Milieu. In the context of economic development conditions, if we call physical conditions an economic ecosystem, it would be easier to understand Milieu as human and soft conditions. Some argue that the central concepts are Tacit knowledge and Social Capital, but there is a tendency to keep such discussions in a black box (e.g. Nishizawa ed 2012).

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This study discusses the assumption that the premise of Local Milieu is closely related to management resources. The close relation with management resources in this case does not necessarily depend solely on physical and spatial distances. Proximity based on social relations is important. Economic geography and spatial economics generally characterize regional socio-economic and innovation ecosystems by spatial network interactions of transactions. Understanding the physical and spatial interactions of networks will enable us to increase the efficiency of regional economic, industrial and innovation policies (Mikhaylov, 2018). These interactions are a collection of actors that involve location and are formed based on contextual conditions such as historical background to date and seek mutual benefits by utilizing complementarity and "associated diversity" within the network (Frenken et al.(2007). In other words, decision-makers in corporate management are not least influenced by their communities in the selection of values and management resources that serve as criteria for decision-making (Cristache N et al, 2021).

Therefore, realistically, proximity is not necessarily just physical distance, but also it involves a concept that includes social and cultural proximity, which is replaced by social relations capital (Tatemi, 2019:13). This concept of social capital is also very broad, starting with local activities such as school and daily life, and including political connections (for example, Misumi, 2013), so we will consider limiting this concept of social capital to an entrepreneur network (a network that concurrently serves as a corporate officer). In general terms, social capital here is expressed as "Human relations", but sociologically it is expressed as "Tie". Although relationships with other companies are necessary to manage a company, a relationship can be formed by concurrently serving as directors of multiple companies and cooperating with each other and also checking conflicts of interest (Cristache N. et al, 2019). From this, we believe that the director network of the company can be an important indicator to form the Milieu.

In business management, cooperation between entrepreneurs can be achieved, even if the number of people is scarce, because of the cooperation system that is capital and management know-how (Bibu N et al, 2016). In particular, the more industries require capital, the more collaborators will be. From this assumption, we will clarify the cooperation from the elucidation of the network, and regional disparities and changes (Nastase M. et al, 2020).

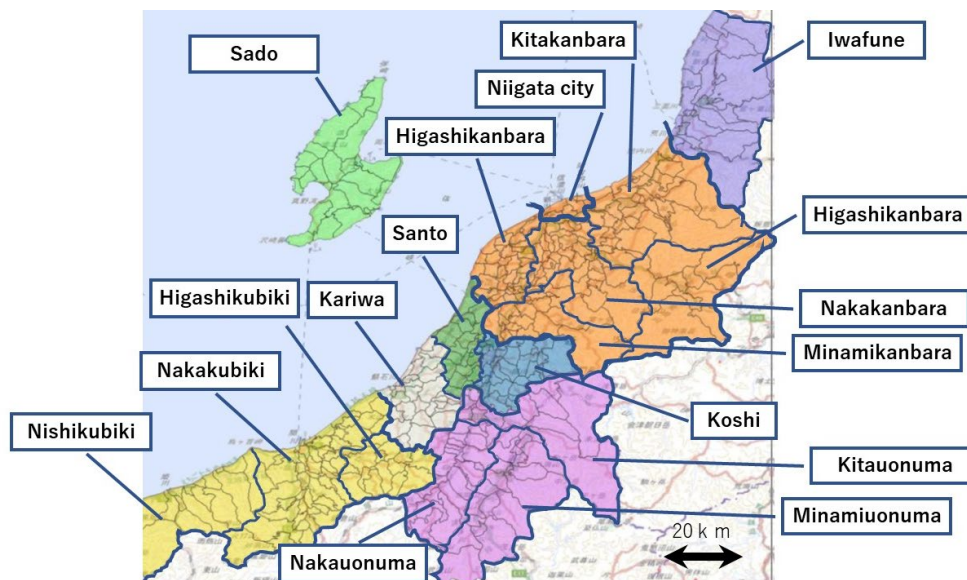
## **2. Identification of the problem**

In the logic of the microeconomics approach, the industrial size of a city determines its static efficiency, and the increase in its efficiency creates the competitiveness of a company, and as a result, the growth opportunities of the place where the company is located tend to be explained.

Furthermore, looking at real society, the industrial scale of the city changes greatly, including the decline of such industry. In the future it should be easy to have an advantage from the viewpoint of population size, etc. However, in the

same prefecture, the prefecture's capital is not necessarily an economy. In the abolition of clans and establishment of prefectures, the boundaries of the present-day borders of prefectures were established based on the ritsuryo system, but there are not a few cases in which large influential domains were divided or small domains were forcibly merged to contain the power of the former domains, and prefectural offices were established to avoid areas where jinya (regional government office) were located. In fact, it can be seen in several prefectures that the industrial productivity is higher in other cities than in the prefecture's capital (Gabor M.R. et al, 2019). This differs not only in the presence of large companies, but also in the atmosphere in which they intend to start (Watahiki, 2020 a).

In this study, we analyse Niigata Prefecture. Although Niigata city has a large population since around the time of the abolition of feudal domains and establishment of prefectures, the number of companies established lags far behind that of Koshi county. Niigata city was a port of call for Kitamae-bune ships, and supplies from inland areas by the Agano and Shinano Rivers gathered, and in addition, the Niigata Plain was a major producer of rice and also had a rice association. In addition, it was opened as a port by the Treaty of Ansei, and it had a large prefectural capital with many wealthy people in the shipping industry. However, Niigata city's corporate network remained small until the Russo-Japanese War.



**Figure 1 Administrative districts in Niigata Prefecture in 1897**

On the other hand, even though 80% of Nagaoka City was scorched by the Hokuetsu Boshin War ("War that occurred in Niigata Prefecture in June 1968, forcing the forces supporting the Meiji government and the Edo Shogunate to clash."), it initially created an industrial cluster of banking, oil, paper, and iron

industries with local residents without relying on capital from outside the region. We wonder what is the cause of this difference? As mentioned above, commerce and industry generally appear to be linked to the size of the population, but it does not necessarily seem to always be the case.

Table 1 provides an overview of the population and officers in 1897. Looking at this, it seems that the number of officers has nothing to do with the size of the population and the size of the density. Niigata City has a large population, and when the abolition of feudal domains and establishment of prefectures was carried out, it became the prefectural capital.

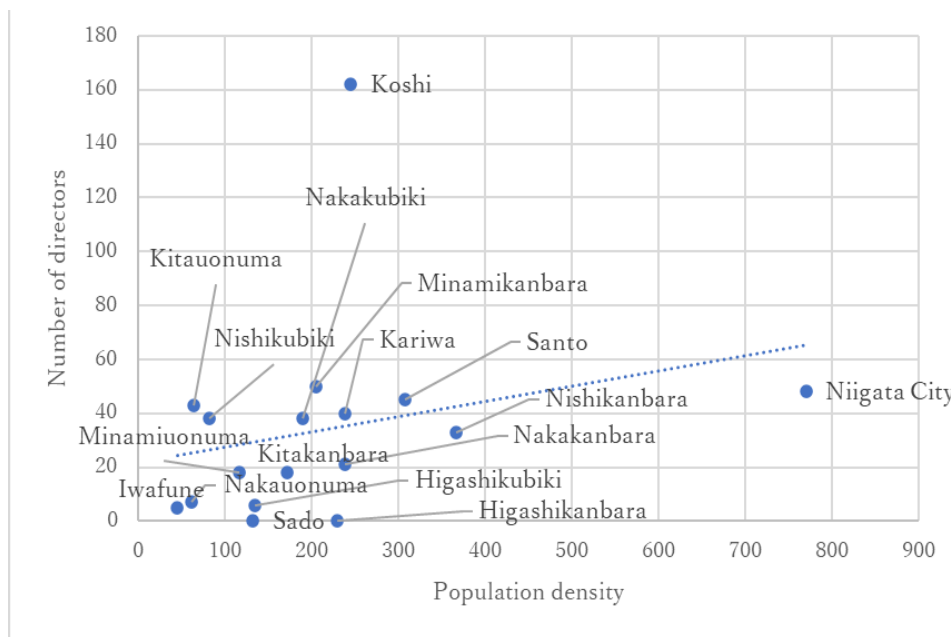
**Table 1. Population and area in 1897**

<b>Region</b>	<b>Area (Km<sup>2</sup>)</b>	<b>Population</b>	<b>Population density (people/km<sup>2</sup>)</b>	<b>Directors (persons)</b>
Niigata city	64.7	49874	770.85	48
Kitakanbara County	1146.78	196788	171.60	18
Nakakanbara County	761.06	181273	238.18	21
Nishikanbara County	421.34	154424	366.51	33
Minamikanbara County	605.62	124258	205.17	50
Higaskanbara County	87.04	19994	229.71	0
Santo County	336.84	103564	307.46	45
Koshi County	495.11	121451	245.30	162
Kitauonuma County	1065.12	68042	63.88	43
Nakauonuma County	952.81	58145	61.02	7
Minamiuonuma County	631.6	73958	117.10	18
Kariwa County	514.7	122476	237.96	40
Higasikubiki County	437.35	58636	134.07	6
Nakakubiki County	1139.81	216480	189.93	38
Nishikubiki County	814.62	67189	82.48	38
Iwafune County	1485.1	67434	45.41	5
Sado County	856.92	113719	132.71	0
Niigata Prefecture as a whole	11816.52	1797705	152.13	572

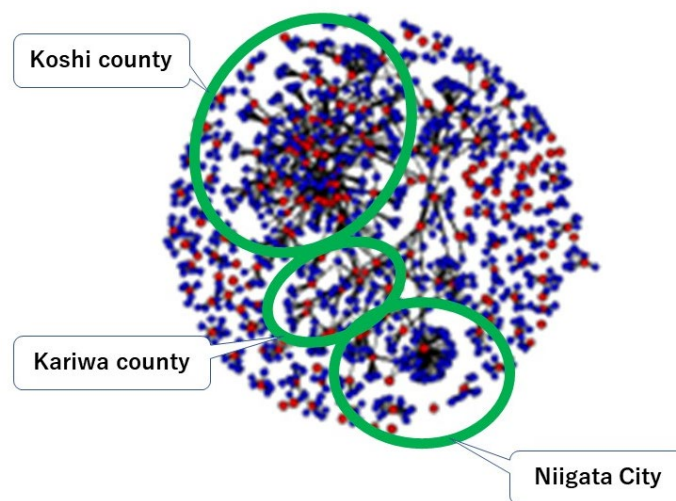
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Source: "Records of directors of various Companies in Japan 1897 Edition" and "Statistics of Niigata Prefecture 1897 Edition"

Figure 2 shows that in 1897, Koshi County had an outlier. This may be due to the development of the oil industry, but the Nishiyama oil field in Kariwa and Santo Counties and the Niitu Oil field in Nakakanbara County and the oil industry still existed around the same time.



**Figure 2 Population density and number of directors in 1897**  
 Source: "Nihon Zenkoku Shogaisha Yakuinroku 1897 edition"  
 and "Niigata Prefecture Statistics 1897 edition"



**Figure 3 Illustration of Company and Director Network**

Figure 3 is a two-part graph connecting the company and the company directors belonging to it by a line based on "Nihon Zenkoku Shogaisha Yakuinroku1897 edition", which will be described later. The red dot represents the company and the blue represents a director or auditor. Looking at this, we can see how each region is connected.

Why did it become like this? It seems that the reason is not just population density. In the first place, it seems that there is not only a problem of the number of people but also a problem of they connect. In other words, it seems to be a difference between a state where there are only people in the area or a state where people communicate with each other and have a common interest, but this seems to be a spectrum structure rather than a two-choice.

Therefore, the purpose of this study is to clarify what differences exist in the way of regional connections.

### **3. Methods**

#### **3.1 Data Sources and Processing**

"The Records of directors of Various Companies in Japan" was published from 1893 to 1942. For each company established in Japan, the company name, location, capital, dividend amount, name of directors and address are listed. Although some of the listed companies are missing, there are no other historical materials that cover Japan and have detailed data. There are also many typos and omissions in the description, but this is a characteristic of the times, and even the name of an individual was sometimes used with its phonetic equivalent. Since it is not recognized as the same person in such cases, it is considered the same person from the character string of the person's name and address to Levenshtein distance 1. The 1897 edition of this book was made into a database, and two-part graphs of company directors and affiliated companies were created using statistical software R, and centrality analysis was carried out. Degree centrality, betweenness centrality and eigenvector centrality were analysed. See Wasserman and Faust (1994) and Inaba (2009) for the calculation method of each centrality.

#### **3.2 Heat Map**

Next, from the centrality of company officers living in each town and village, we created a heat map using the software QGIS of the geographic information system.

A heat map is a method of visualizing using shades of multiple colours for the purpose of visually expressing the relationship between the magnitude and magnitude of a numerical value. In this study, the distribution of directors weighted by the centrality index was made into a heat map, and data visualization and relative evaluation were attempted.

### **3.3 Industry around 1897**

The port of Niigata became an international port under the Pact of Opening ports of Ansei era (1858), but the port was opened in 1867 without any improvement of the port. Although the port was opened, the period it was used was short due to the seasonal wind in winter, and because it was a shallow sea, large ships could not dock, the cost was high because the cargo was put on a small boat from the port and replaced with a large ship from foreign countries, and the price of goods (mainly textiles, like silk products) was forced to lower, and this resulted in a situation where exporting from Yokohama Port could obtain a higher profit (Aoyagi, 2011). As a result, the volume of transactions at the Port of Niigata decreased, and the British Consulate withdrew in 1879 and the German Consulate in 1882. At this time, it practically ceased to function as an international trade port.

In particular, the historical background of 1897 was the period when the Sino-Japanese War had just ended and the second company establishment boom occurred. In addition, railways were gradually being developed in the prefecture, and shipping along the coast of the Sea of Japan began to fade in terms of domestic transportation. Since the railway was not open between Niigata and Nagaoka at the investigation stage, transportation by riverboat of the Shinano River was still alive.

As for the oil industry, although oil was not excluded from underground resources in the Nippon Mining Law at first, the subsequent Mining Ordinance (1890-1905) stipulated that ownership of land and mining rights of underground resources were separate, and it was possible to mine if the landowner paid the mining rights to the landowner. By this time, electricity was only partially supplied, and household lighting was switching from rapeseed oil to brighter kerosene, which is now being consumed nationwide. Consumption exceeded production, and Japan at the time imported oil from Russia, United States and Romania.

### **3.4 Politics**

If we are to make an analysis on the political situation in Japan, the Niigata Prefectural Assembly began in 1880. The election at that time was not a stand-up system, so it was a precarious congress with a succession of resignations, but by 1897 it had become a stand-up system as it is now. However, the right to be elected was subject to direct payment of 15 yen or more of the national tax. According to the Income Tax Law at that time, it is believed that salaried income earners could not get the right to vote so easily because they needed an income of 1,000 yen to pay an income tax of 15 yen. It may be considered that the right to vote was not obtained unless one was practically a landowner.

## **4. Centrality analysis**

### **4.1 Degree centrality in 1897**

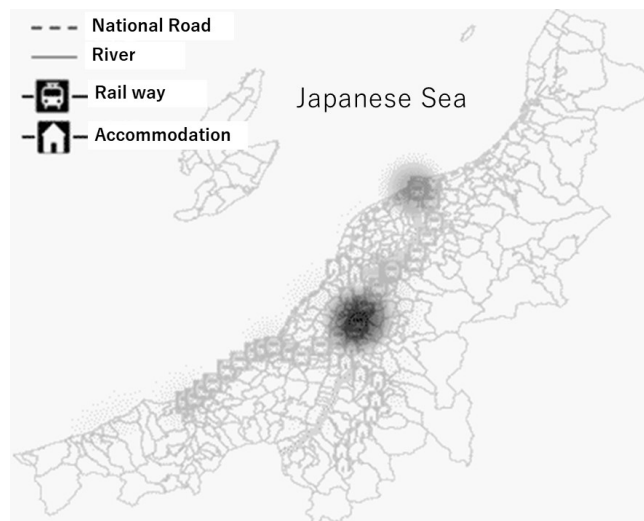
At that time, the number of companies established in Niigata city was small, with more in Koshi County. The oil industry is the cause for this. At that

time, oil could be extracted even by hand digging, and it was around the time that machine digging was gradually replaced. In other words, the necessity of introducing machines differs depending on the oil well, and there was a big difference from the companies that introduced large-scale machines from that of job level of farmers. On a larger scale, it was necessary to manage the investment amount from large-scale mining machines to a series of flows from essential oils to distribution and sales after oil extraction.

Although the oil fields in Koshi County were large, there were many small and medium-sized landowners, unlike Niitsu oil field, and there was a time when oil was not considered as a taxable object of underground resources under the Nippon Mining Law, and small-scale oil drilling companies were born.

On the other hand, there were not so many oil fields in Niigata city such as in Koshi County. The Niitsu Oil field was located in neighbouring Nakakanbara County, but the landowner, Kanichi Nakano, was a large landowner, so there was no need for incorporation for a long time. In addition, Kanbara was located in the Niigata Plain, and there were many large landowners, and around present-day Chuo-Ku Niigata city, there were many shipping wholesalers and shipping businesses. At that time, land transportation was not well developed, so as mentioned above, it was an important transit port for domestic transportation. As for the transportation industry, although it became legally free to enter by abolishing the seats, the transaction structure from the Edo period did not change easily. In other words, because there were many wealthy farmers and wealthy merchants, not only did there not change the conventional trading structure, but there was no need to scale up by investing capital from others. As a result, networking has not progressed (Watahiki, 2020b).

As a result, degree centrality is overwhelmingly stronger in Nagaoka and smaller in Niigata, the prefectural capital.



**Figure 4 Heat map of people with high degree centrality in Niigata Prefecture in 1897**



**Table 2. Degree of centrality within top 10 areas in Niigata Prefecture in 1897**

Full name	Settlements in 1897	Degree centrality	Companies as of 1897	Political activities
Kan-ichi Nakano	Tushima Village Nakakanbara County	12	Nippon Oil Corporation, Niigata Kogyo, Echigo Oil, Fuso 20 Pits oil, Oodaira 10 Mines, Fuso Union, Tuchigaya oil, Ushiroya oil, Kitadaira oil, Chuetu oil, Meiji Oil, Nagaoka Pipeline	1911-16 Members of the House of Representatives
Junpei Ueguri	Yamamoto Village Koshi County	12	Shuei oil, Koshi-Houden oil, Nihon-Kaiyo oil, Echigo dril, Takatu oil, Fuso-Kyodo oil, Jigokudani oil, Seirin oil, Nagaoka oil, Meiji Oil, Nagaoka oil refining, Nagaoka Pipeline	—
Iwakichi Shinbo	Koshi County Shin-Machi	10	Oodaira oil, Myoei oil, Nanetu oil, Oodaira 10 mines, Akebono-Oodaira oil, Meishin oil, Koshitani oil, Toetu oil, Kougo oil, Urase oil	—
Iwamatu Takamatu	Koshi County Senju Town	9	Nihon-Kaiyo oil, Takayama oil, Hinomoto oil, Akebono-Oodaira oil, Takatu oil, Meitoku oil, Echigo Oil Mining, Meiji Oil, Toyo oil	—
Matujiro Nomoto	Koshi County Nagaoka Town	8	Imperial Mining, Tohoku Oil, Koshitani Oil, Takehira Oil, Enoki oil, Kitadaira oil, Nagaoka oil refining, Nagaoka rice exchange	1912-1916 Nagaoka City Council
Torajiro Matuda	Koshi County Nagaoka Town	8	Koshi Houden Oil, Takayama oil, Hinomoto oil, Echigo Oil Mining, Jigokudani oil, Hinode oil, Nagaoka oil, Nagaoka Pipeline	—
Matasichi Yamada	Koshi County Nagaoka Town	8	Koshi Houden Oil, Takayama oil, Myoei oil, Hinomoto oil, Takatu oil, Fuso-Kyodo oil, Hinode oil, Meiji Oil	—

Full name	Settlements in 1897	Degree centrality	Companies as of 1897	Political activities
Kyusaburo Kurata	Niigata city Magusakawagishi	6	Niigata Kogyo, Nihon-Kaiyo oil, Takayama oil, Echigo Oil, Ushiroya oil, Nagaoka Pipeline	—
Shosaburo Koide	Koshi County Nagaoka Town	6	Nihon-Kaiyo oil, Nakao oil, Hokuriku oil, Kitatani oil, Akebono-Oodaira oil, Meitoku oil	—
Jinzo Tuboi	Koshi County Nagaoka Town	6	Zao oil, Oodaira oil, Imperial mining, Chuetu oil, Toyo oil, Nagaoka oil refining	—

Looking at Table 2, 10 directors with a high degree of centrality are mainly engaged in oil drilling, oil transmission, and essential oil industries. In particular, it was found to be an oil-related industry within Koshi County.

As a political figure, it was confirmed that Kanichi Nakano became a member of the diet and Matsujiro Nomoto became a member of the Nagaoka City Council 15 years after this time.

#### 4.2 Betweenness centrality in 1897

There are many people at the top of betweenness centrality who are not at the top of degree centrality. Koshi County, centered around Nagaoka, was the most central place. This is followed by Niigata, but individual directors living in Niigata do not come out in the top. It appears slightly in Minamikanbara (present day Tubame City · Sanjo City), Kitauonuma County (present day Ojiya city) and Kariwa County (present day Kasiwazaki city). KitaUonuma county had a temporary oil drilling operation, but it did not surpass the textile industry, its main industry. On the other hand, the textile industry was basically an extension of the individual industry that farmers did during the off-season, and there were textile wholesalers and financial institutions for settlement. Kariwa County was the second-largest oil industry in the country, with Nippon Oil Corporation and the pipeline and Warehousing industry.

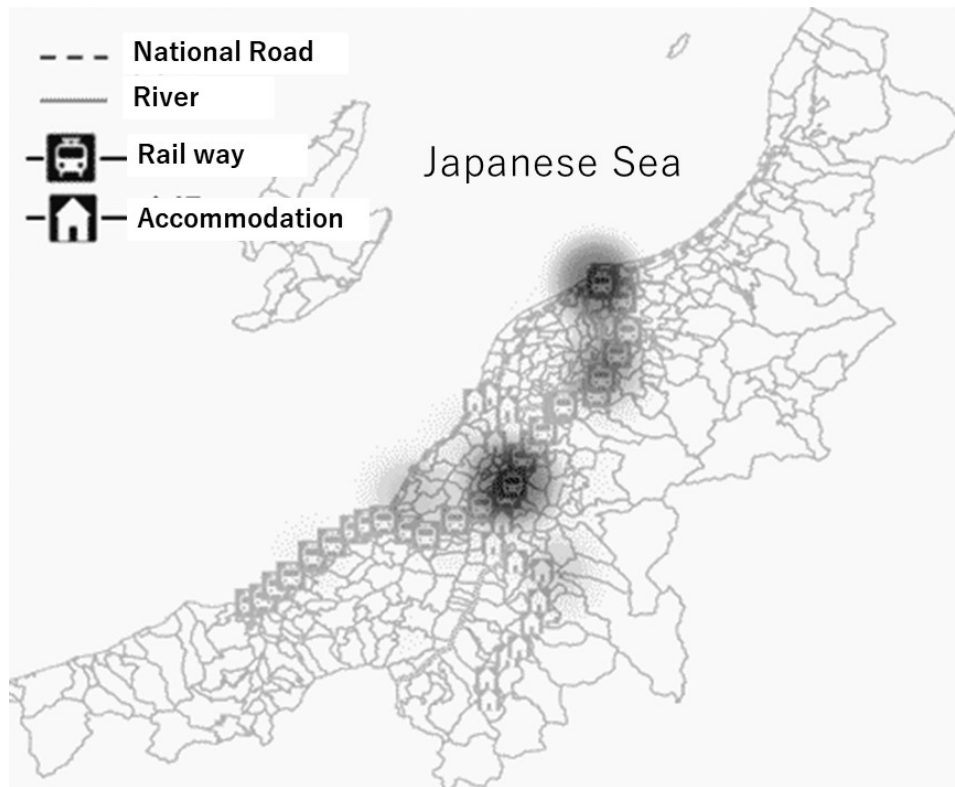


Figure 5. Heat map of people with high betweenness centrality in 1897

Table 3. Betweenness centrality top 10 in Niigata Prefecture in 1897

Full name	Settlements in 1897	Betweenness centrality	Companies as of 1897	Political activities
Kanichi Nakano	Tushima Village Nakakanbara County	75271.9	Nippon Oil Corporation, Niigata Kogyo, Echigo Oil, Fuso 20 Pits oil, Oodaira 10 Mines, Fuso Union, Tuchigaya oil, Ushiroya oil, Kitadaira oil, Chuetu oil, Meiji Oil, Nagaoka Pipeline	1911-16 Members of the House of Representatives
Yoshimasa Makiguchi	Arahama Village Kariwa County	31846.6	Niigata Bank, Kshiwazaki Bank, Hokuetsu Rail Way, Naoetsu Warehousing, Naoetsu Rice and salt exchange	1893-1897 Prefectural assembly member
Chohachi Hirokawa	Sanjo town Minamikanbara county	30060.2	SanjoBank, Sanjo Saving Bank, Niigata Sulfuric acid	—

Full name	Settlements in 1897	Betweenness centrality	Companies as of 1897	Political activities
Kishichiro Koide	Niigata city	29506.8	Anshin sha, Echigo Oil, Hokuju Oil, Nagaoka Pipeline, Niigata Commodity Exchange	—
Shuhei Matuda	Koshi County Nagaoka Town	27915.6	Anshin sha, Koshi Houden Oil, Nagaoka oil, Meiji Oil, Nagaoka Pipeline	1909 - 1912 Nagaoka City Council
Sadakichi Kuribayashi	Niigata city, Furumachi-dori	25545.4	Niigata Saving Bank, Anshin sha, Niigata Grain Exchange	—
Yusaku Kubota	Ojiya town Kitauonuma county	25189.1	Ojiya Bank, Uonuma Kaida	1892 - 1894, 1903~04 Prefectural assembly member
Ueguri, Junpei	Yamamoto Village Koshi County	23971.1	Shuei oil, Koshi Houden Oil, Nihon-Kaiyo oil, Echigo dril, Takatu oil, Fuso-Kyodo oil, Jigokudani oil, Seirin oil, Nagaoka oil, Meiji Oil, Nagaoka oil-refining, Nagaoka Pipeline	—
Hidesaburo Kusumi	Ojimaya village Santo County	21896.2	Nagaoka Bank, Yoita Bank, Teradomari Bank, Nippon Oil Corporation	1879 - 1882, 1886 - 1889 Prefectural assembly member, 29 Santo County Councillor
Masuro Ootuka	Katakai village Santo County	20386.4	Nagaoka Bank, Ojiya Bank	1886-1891 Prefectural assembly member, 1898-1902 Katakai Village head

Round to 2 decimals

In Table 3, Kanichi Nakano is mentioned above at the top. Yoshimasa Makiguchi, the second-largest company, is also a board member of the Hokuetsu Rail Way, Warehousing, Exchange, and many other sectors of the transportation industry, with a focus on finance. The top 10 in degree centrality are directly related to oil industries such as oil extraction and refining, while the top 1 in betweenness centrality are the oil industry and the finance industry for its settlement.

Degree centrality is mostly composed of the oil industry, while the medium variable is conspicuous for both the oil industry and the finance industry.

In addition, around 1897, some people became politicians, and with the exception of Kanichi Nakano, they became members of the county or prefectural assembly.

### 4.3 Eigenvector centrality in 1897

The eigenvector centrality is shown in Figure 3, but it rarely appears in Niigata City, where Koshi County is strong and Minamikanbara county (present-day Sanjo City) is slightly seen. This is thought to be a connection centered on Minamikanbara county, where the boat dock is located due to the movement of the Shinano River by river boats. Eigenvector centrality is an indicator that is essentially a partition in the community. Initially, it was thought that Niigata, which has political influence, would appear strongly, but Niigata city has little eigenvector centrality. This is due to the fact that, as mentioned above, companies exist but there are few concurrent relationships, and the community is not so much formed.

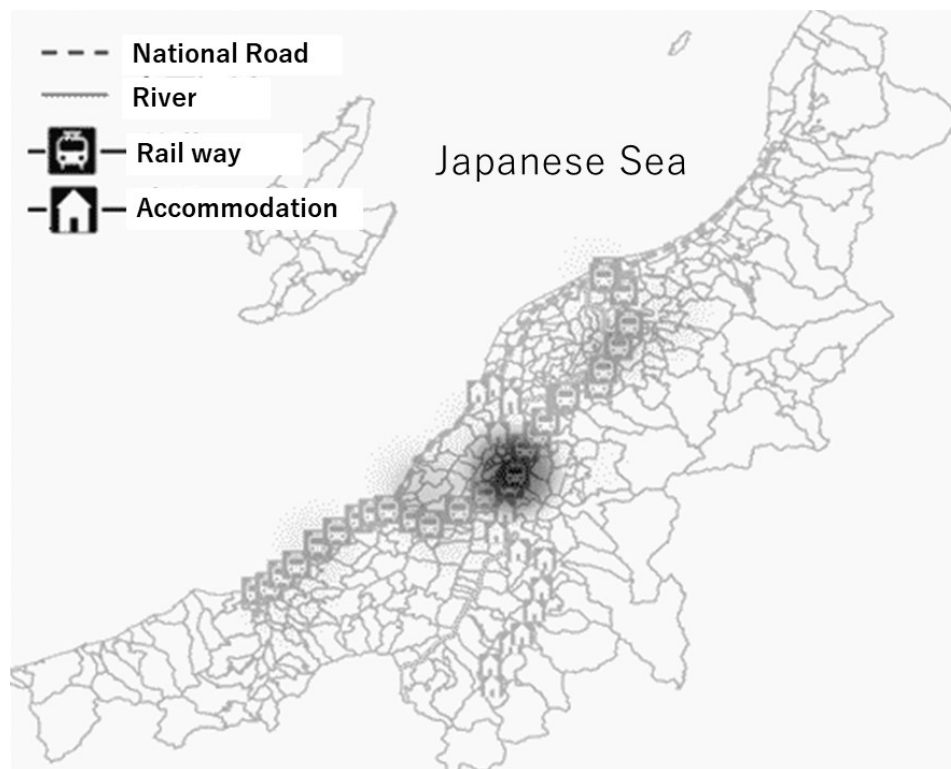


Figure 6. Heat map of people with high eigenvector centrality in 1897

**Table 4. Eigenvector centrality top 10 in Niigata Prefecture in 1897**

Full name	Settlements in 1897	Eigenvector centrality	Companies as of 1897	Political activities
Kanichi Nakano	Nakakanbara County Tushima village	0.125	Nippon Oil Corporation, Niigata Kogyo, Echigo Oil, Fuso 20 Pits oil, Oodaira 10 Mines, Fuso Union, Tuchigaya oil, Ushiroya oil, Kitadaira oil, Chuetu oil, Meiji Oil, Nagaoka Pipeline	1911-16 Members of the House of Representatives
Hidesaburo Kusumi	Santo County Ojimaya village	0.063	Nagaoka Bank, Yoita Bank, Teradomari Bank, Nippon Oil Corporation	Santo County deputies
Shoji Hirokawa	Santo County Ojimaya village	0.063	Nagaoka Bank, Nippon Oil Corporation, Nakao oil	1895-1897, 1899-1903 Prefectural assembly member
Hisahiro Naito	Kariwa County Ishiji town	0.061	Nippon Oil Corporation, Echigo Oil	1885-1891 Prefectural assembly member, 1894-1898 Diet member
Gonzaburo Yamaguchi	Kariwa County Yokozawa village	0.061	Nagaoka Bank, Nippon Oil Corporation	1879-1882, 1884-1889 Member of the prefectural assembly
Shosaburo Makiguchi	Kariwa County Arahama village	0.058	Naoetu Bank, Nippon Oil Corporation	1879-1880 Prefectural assembly member
Shinsaku Honma	Nakakanbara County Sinseki village	0.058	Nippon Oil Corporation	1879-1881 Prefectural assembly member
Mankichi Yamaguchi	Koshi County Nagaoka Town	0.058	Nippon Oil Corporation	1906-1912 Nagaoka City Council
Tadashi Watanabe	Santo County Amase town	0.058	Nippon Oil Corporation	—
Yamaguchi Seiji	Niigata city Nisiohata cho	0.058	Nippon Oil Corporation	1906-1920 Nagaoka City Council

Round to 4 decimals

Looking at the top of Table 4, there is only one Koshi County resident. Instead, in the Chuetsu region, there are many residents around the present-day border between Kashiwazaki City and Nagaoka City. Kanichi Nakano has a large

number of concurrent positions, but other than that, he is a member of Nippon Oil Corporation. Hisahiro Naito was the only member of parliament while serving as a board member of Nippon Oil Corporation, but he has been a politician for some time. In the preparation of this table, the centrality analysis was calculated without the elements of politicians, and it seems that Nippon Oil Corporation gathered politicians or became politicians later after being influenced while working at Nippon Oil Corporation. The Shokusan association, a cross-industry exchange event in the Shinano River basin, probably has a large influence (Ishikawa, 1999).

In addition, 7th place or less belong only to Nippon Oil Corporation and do not concurrently serve as board members of other companies. This is because Nippon Oil Corporation has a large influence in creating the two-part graph.

## 5. Comparative study

Figure 1-3 shows that there are significant differences in the way the network is connected to each other, depending on the region. Koshi County is strongly represented entirely by its centrality. This seems to be due to the fact that there are many directors prominent in Koshi County.

In terms of degree centrality, Niigata city is second only to Koshi County. Nishikanbara, Minamikanbara, KitaUonuma, Kariwa, NakaKubiki appear to have the same number of directors in each county.

It does not appear in each county of NishiKubiki.

With respect to betweenness centrality, Koshi County and Niigata city appear on a similar scale, with only a few in southern Kanbara, Kariwa and Santo Counties in the middle. Minamikanbara county is particularly located near the old town of Sanjo (now Sanjo City), where the Ikarashi river and Shonano river meet, and where the boathouse is located. Kariwa and Santo County were the sites of the Nishiyama Oil Field and Nippon Oil Corporation.

Betweenness centrality figures range from Kanbara to Koshi, Kariwa, Santo County, and the so-called Niigata city to Chuetsu, but do not appear in the Joetsu, Kaetsu, and Uonuma regions. As for politicians, starting with the diet members who also appeared in degree centrality, around 1897 there were 4 prefectural members.

Regarding the eigenvector centrality, Koshi County appears only strongly in the region, not in other regions. However, in the upper ranks, only 1 in Koshi County are gathered in Kariwa County and Santo County. Regarding politicians, one person has become a politician and the other nine have become members of parliament.

In this way, the upper person when looking at Tables 2 to 4, completely different from the situation of the heat map.

Nevertheless, directors at Nippon Oil Corporation, which is headquartered in Kariwa County, are the top directors at eigenvector centrality. Since the officers' settlements are dispersed outside Kariwa County, it is possible that Kariwa County did not have a high proportion. In other words, Nippon Oil Corporation's company itself is highly centralized, but its officers live in other regions, while in the case of

Koshi County, both officers and companies were local. This leads to the same conclusion as the study of Naito (2003).

Next, looking at the top 10, there are directors from Santo County and Kariwa County residents, but they are not shown in Figure 3. The reason for this is that although there are certainly higher ranks in both counties, there are many higher and middle-ranking directors in Koshi County's eigenvector centrality. In other words, there is a difference between the distribution of a small number of people with a high score and a large number of people with a medium score.

Koshi County, including Nagaoka, had a large number of small companies, mainly in the oil industry, and large companies such as Houden Oil, up until the major merger in Meiji 39(1906), and were operating with local capital and local personnel (Naito 2003:205-213).

**Table 5. Ranking of each centrality and its Trends**

	<b>Strong areas</b>	<b>Residence of the director</b>	<b>Place of appointment</b>	<b>Politicians</b>
Degree centrality	Koshi County	Koshi County	Oil industry	Almost none
Betweenness centrality	Koshi County, Niigata town	Koshi County, Niigata city, Minamikanbara county (along the Shinano River)	Oil industry and related industries	Member of the prefectural assembly, member of the city and county council
Eigenvector centrality	Santo County, Kariwa County	NakaKanbara County, Santo County, Kariwa County	Oil industry or finance industry	Member of the prefectural assembly

It is summarized in Table 5 for each centrality. Kanichi Nakano was ranked first in 3 centralities, and he was a member of parliament.

## 6. Summary

In this study, the heat map was prepared from the centrality of company directors living in various places in Niigata Prefecture, and the top 10 persons were clarified. From this heat map, the way of appearance was different in each centrality depending on the region.

In particular, there was a tendency for politicians to come out from high figures of betweenness centrality and eigenvector centrality, and the results showed that the indicators of each centrality were representative.

On the other hand, the strong centrality in the region did not necessarily coincide with the residence of the person ranking first of each centrality, and it did not reflect the entire region. This time, it seems to be due to the fact that it was drawn based on the address of the company director, so it seems to be necessary to measure from the case where this was replaced by the company-centered. In the



future, time-series analysis will be necessary to look at how it affected the development of public transportation and the formation of networks, and the impact on the region by the relocation of directors.

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