

# ON THE FORMATION OF PRODUCTION NETWORKS OF SMALL BINOCULAR MANUFACTURERS IN JAPAN'S EARLY POSTWAR PERIOD

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**ABSTRACT:** In Japan's early postwar period, binoculars became a leading export product. Nearly a hundred percent of binoculars made in Japan were shipped to the United States in the early years after exporting began. Japanese binoculars were able to take over 90 per cent of the U.S. import market for more than a decade from mid 1950s.

What factors made it possible for Japanese binoculars to show the remarkable performance in the U.S. import market for more than a decade? To investigate sources of the competitiveness of binoculars in those days will be helpful to understand conditions of industrial development, because this case may add an illustrative example of the emergence of competitive SMEs (Small and Medium Enterprises) in a chaotic economy.

Quality is an element of competitiveness. A method of press-molding optical glass was, among other things, recognized as a comparatively advantageous technology which was inherited from the wartime development of optical munitions directed by the Japanese Navy and Army. Thus, the quality was largely ensured by the technology and other inherited skills.

On the other hand, price competitiveness of Japanese binoculars derived mainly from a flexible manufacturing system of specialized firms which were agglomerated as a cluster in the northern part of Tokyo after the end of the war. This production system as a network was formed by small assembly and component manufacturers.

In this paper I will show a brief history of binocular development in Japan and refer to the main background of competitiveness of this industry in the early postwar period. In this context, factors creating networks of small specialized binocular firms in a particular area of Tokyo are focused upon. Further, the effectiveness of these networks is discussed.

**KEYWORDS:** binocular, SMEs, network

## 1. INTRODUCTION

When Japan could start exporting again in the early postwar period, binoculars were a leading export item along with other light machinery products such as bicycles and sewing machines. For the first couple of years, nearly 100 percent of binoculars

made in Japan were shipped solely to the United States. It was not so long before Japanese binoculars took over more than 90 percent of the share of the import market on binoculars in the U.S..

What made it possible for Japanese binoculars

to capture such a predominant market share in the U.S. for more than a decade? It will be helpful to investigate factors of the competitiveness of binoculars in those days, because this case may present an illustrative example of the emergence of competitive SMEs (Small and Medium Enterprises) in a chaotic economy.

In this paper, the performance of Japanese binoculars in the U.S. import market during the early postwar period is described in Chapter 2. In Chapter 3, the historical development of Japanese binocular industry in prewar days is explained. Then in Chapter 4, the postwar development of the industry is written. In Chapter 5, factors of competitiveness of Japanese binoculars are explained. Here, competitiveness is divided into quality and price elements and both are explained in what way competitiveness of those elements were attained. Finally, implications of this case are discussed in Chapter 6 as a conclusion.

## 2. JAPANESE BINOCULARS IN THE U.S. IMPORTED MARKET

There appeared an obituary notice in the NY Times on March 31, 2005 (p.25 column 5) as follows:

*David P. Bushnell (March 31, 1913 - March 24, 2005) was an American entrepreneur. Mr. Bushnell founded his company, Bushnell, in 1948. At that time, binoculars were largely an item of luxury. Through a strategy of importation from foreign markets, Bushnell made binoculars widely available to middle-class Americans for the first time.*

*Bushnell died at the age of 91 at his home in Laguna Beach, California. He was a quartermaster with the U.S. occupying forces in Japan after World War II and he was*

*assigned to evaluate the products manufactured by the Japanese. He related that most of the products were of very low quality but that the optics were of extremely high quality and very inexpensive. These high quality binoculars became very popular and were the first product of his successful business.*

As the obituary noted Bushnell contributed to transforming a binocular from a luxury item to a daily use product by importing Japanese binoculars, and they were successful in capturing the U.S. market. In 1950s and 60s, Japanese binoculars took more than 90 per cent share of the import market on binoculars in the U.S. (Table 2.1).

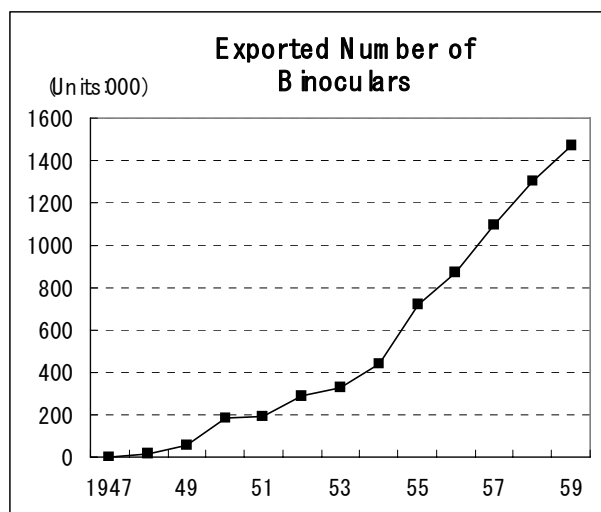
Table 2.1 Japanese Binocular Share in the U.S. Import Market

Year	Quantity	Value
1954	89.7 %	85.6 %
1958	98.6	96.6
1963	98.1	95.1
1967	94.3	92.6
1968	94.2	93.2
1969	90.4	90.2
1970	88.1	89.3
1971	87.4	--
1972	83.7	86.7
1973	78.4	82.7

(Source) Kikai Shinko Kyokai (1977:108)

What kind of factors made such an internationally competitive industry? The development of the binocular industry in Japan seems to present some clues about the pattern of economic development.

Figure 2.1



(Source) Data from Kikai Shinko Kyokai (1977:95)

### 3. PREWAR DEVELOPMENT OF THE BINOCULAR INDUSTRY IN JAPAN

Before continuing on with the post-World War II development, it will be helpful to look back at the early history of the industry. To know how Japanese optical technology was developed in the pre-war period seems to be essential to understand the post-war development of the industry.

The first prism-type binocular was reportedly made by Carl Zeiss in Germany in 1893, followed by Goerz in Germany and Ross in Britain. Zeiss binoculars of 6 and 8 powers were imported by Konishiroku Co. before Sino-Japan War (1894-1895) for military use.

In 1911, the first Japanese prism-type binocular (“Victor”) was made by Fujii Lens Seisakusho founded by Ryuzo Fujii in 1908. Before starting his business, Fujii had been a Japanese Navy engineer and sent to study optical technology in Germany. During the study Fujii visited London and dropped in at a shop of Ross. The shop master was well acquainted with him and showed a newly made prism-type binocular which was the first

product of that kind in England. Fujii could purchase the sample product which was not for sale and he returned to Japan with this binocular.

In 1908 a precision machine manufacturing factory, Seiki Seisakusho, was established within the Army’s Arsenal in Tokyo and manufacturing of binoculars began in the work. When the First World War broke out in 1914, many of precision instrument materials and products like optical glass and binoculars could not be imported from Europe. The Navy thought it was urgently necessary for Japan to ensure self-sufficient capabilities of the strategic products which could not be made domestically. Therefore, the Navy urged several private companies to establish one large optical munitions manufacturer. The Navy asked Mitsubishi for its cooperation and in July 1917, Nihon Kogaku Kogyo Kabushiki Kaisha (later NIKON) was founded by merging the Optical Works Division of Tokyo Keiki and Iwaki Glass Company. Both were small but had leading optical technologies. In the following year, May 1918, Fujii Lens Seisakusho was merged into the company. Mitsubishi was the major share-holder of the company.

While Nihon Kogaku worked mainly for the Navy, the Army which had been in a rapid expansionary movement needed another optics company which could meet the demand. The Army asked Seikosha (Hattori Clock) which had a technology of Optical Instruments for its cooperation. In 1932 the Tokyo Kogaku Kikai Kabushiki Kaisha (later Topcon) was founded mainly by the Hattori family. Katsuma Kogaku Kikai Seizosho which had manufactured lens and binoculars for Hattori was merged into the new company.

Thereafter, the Army procured optical munitions from Tokyo Kogaku as the main supplier, while the Navy procured mainly from Nihon Kogaku as before. However, owing to expansion of battle lines, demands for optical munitions grew further to a dozen times of existing production capabilities.

To cope with this situation, the Army promoted projects of cultivating private optical instrument plants, resulting in a pick-up of eight competent binocular manufacturers such as Tomioka Kogaku, Takachiho Kogaku (later Olympus Optical Co.) and Yashima Kogaku<sup>1</sup>. The group was named as "Hachi Ko Kai" ("Eight Lights Association"). They had meetings regularly on every eighth of months to exchange information and for mutual cooperation. Materials and testing instruments were provided for them by the Army. They cooperated together in such activities as R&D and visiting plants of other firms. Gradually their technology progressed and they could reach a level of making products on the basis of standardized specification. The Army nurtured the group members in such a way of giving them a special order of binoculars for all non-commissioned officers in 1930s.

As the war was ending, the Navy needed smaller binoculars for the newly organized brigades to guard coast lines of Japan's mainland and islands. In order to standardize specifications for the Navy and the Army, some specification designs of binocular models were provided for these new manufacturers by Nihon Kogaku and Tokyo Kogaku. These specification designs contributed to forge a basis for the models of postwar Japanese binoculars.

#### 4. POSTWAR DEVELOPMENT OF THE BINOCULAR INDUSTRY

When the World War II ended in 1945, Nihon Kogaku and Tokyo Kogaku lost one hundred percent of their orders from the Navy and the Army on which their businesses depended solely. The number of employees of Nihon Kogaku was over 25,000 as of the end of the war but the figure became 1700 in October 1945.<sup>2</sup>

As for Tokyo Kogaku, the peak of the employees totaled about 8000 at the end of the war. All the employees were unemployed after August 1945. The company was permitted to operate again with 200 employees in November 1945. In 1946, the number of employees recovered to 800 by accepting its former employees who returned from overseas. As a result, more than 7000 employees lost their jobs for the case of Tokyo Kogaku.<sup>3</sup>

After several months passed from the end of the war, people who had engaged in binocular manufacturing businesses got together and cooperated to establish two industry associations; the Japan Optical Instrument Industry Cooperative (the established year unknown) and the Japan Optical Precision Machinery Industry Association (April, 1946).

The former was organized by leaders of small and medium scale binocular manufacturers and its initial members consisted of 15 companies. On the other hand, the latter was consisted of major optical instrument manufacturers such as Nihon Kogaku, Tokyo Kogaku, Seiki Kogaku (later Canon Co.) and Konishiroku.

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<sup>1</sup> Kikai Shinko Kyokai(1977:16)

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<sup>2</sup> Nihon Kogaku Kogyo (1960:245)

<sup>3</sup> Kogaku Kogyoshi Henshukai(1955:763)

At that time, optical instrument manufacturers were at a loss what to make in the midst of a chaotic economy. In those days, there were cases in which staff members of the occupation forces visited optical instrument factories and mostly they were interested in binoculars for their souvenirs. Observing this tendency, those manufacturers thought it might be possible to export binoculars.

Representatives asked GHQ for permitting the export of binoculars through the Ministry of Commerce and Industry and the Trade Agency<sup>4</sup>. By asking GHQ many times eagerly, they could start exporting binoculars to the U.S. in August 1947.

Exports of Japan in the early postwar period were administrated by the Trade Agency and the Ministry of Commerce and Industry under the control of GHQ. In July 1947, “the Mining and Industrial Products Trading Public Corporation” was established as a Government organization to centralize trading procedures for mining and industrial products<sup>5</sup>. The Trading Public Corporation purchased exporting goods from domestic private exporters and exported them under the name of the Trading Public Corporation. Being designated as important products for the export, binoculars were required by the Corporation to be inspected by entrusted inspectors. In the early stage, inspectors were sent to working places of exporting companies by major manufacturers like Nihon Kogaku. Quality inspection of exporting goods was regarded to be essential and effective to prevent defective products from being sold in overseas markets.

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<sup>4</sup> Both were reorganized later as “the Ministry of International Trade and Industry” in 1949.

<sup>5</sup> Textiles, foodstuff and raw materials were excluded as they were controlled by separate trading public corporations.

On the other hand, members of the Optical Instrument Industry Cooperative which was consisted of small and medium firms gathered and exchanged information. One day someone heard that the PX (Post Exchange, or retail store) of the Occupation Forces was interested in purchasing binoculars at reasonable prices. The cooperative asked a trading (private) company to sell their products to the PX, resulting in the first order of binoculars. The cooperative as one organization could receive the order. Member firms of the cooperative were very glad to get the order but faced a quite difficult task to control qualities of products made by various manufacturers. There was no inspection institution at that time, so that manufacturers made alternate inspections of other members’ products by themselves before the delivery. The cooperative tried to ensure quality levels and due dates by checking products strictly and visited member factories even late at night.

In this way, manufacturing binoculars became an export industry. During the multiple exchange rates period, the exchange rate of binoculars was set to be 500 yen per one dollar. The binocular manufacturing business was quite profitable before the unified fixed exchange rate was fixed to be 360 yen to one dollar in April 1949. Moreover, what delighted exporters was that they could receive cash as soon as they discounted export bills by banks in a high inflationary period. Observing flourishing firm owners<sup>6</sup>, many firms entered into the binocular manufacturing business, which caused a secular trend of declining exporting prices.

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<sup>6</sup> As exporting amount increased, vehicles used by binocular makers changed from bicycles to motor bikes, then small cars, next big domestic cars, finally to foreign cars.(according to the former secretary of the cooperative, Hiraga)

## 5. FACTORS OF COMPETITIVENESS

### 5.1 An Inheritance of the wartime technology development

One of the reasons why the Japanese binoculars could perform well in the U.S., and later in European markets, in the early postwar period was owing to the optical glass processing technology which had been developed during the war.

The press-molding method of optical glass processing was developed by a glass work expert, Rihachi Sumita who founded Sumita Kogaku Kogyo in 1924. The method was adopted by the Army and the Navy as a common technology after an Army engineer, who was going to be a professor at Tokyo University, acknowledged the supremacy of the method in around 1942.<sup>7</sup> The new method improved yield rates of optical glass processing dramatically to approximately 80 per cent from less than 40 per cent of the previous “cutting process” method in which shaping a block of optical glass into a form of lens or prism was made by cutting.

Table 5.1 Number of Binocular Manufacturers

By Location	
As of July 1965	
Location	Number
Tokyo	199
Saitama	12
Nagano	3
Kanagawa	3
Gunma	1
Osaka	1
Aichi	1
<b>Total</b>	<b>220</b>

(Source) MITI, 1965, *Survey Report on Binocular Component Manufacturers*

Reasons why Japanese binoculars could take overwhelming shares in the U.S. import market for a long time in the postwar period seemed to be partly attributable to almost self-sufficient capability of productive processing of optical glass. With the press-molding process method, Japanese optical glass could be supplied at far less cost than that made in other countries.

Figure 5.1 Itabashi Ward in Tokyo



Table 5.2 Location of Binocular Component

Number of Lens Manufacturers		Number of Body Manufacturers	
Tokyo	169	Tokyo	41
Itabashi	72	Itabashi	29
Arakawa	14	Ota	5
Toshima	12	Arakawa	1
Kita	11	Nerima	1
Nerima	8	Toshima	1
Setagaya	6	Kita	1
Shinagawa	5	Shinagawa	1
Ota	5	Edogawa	1
Other Tokyo	30	Shinjuku	1
Other	65	Other	3
<b>Total</b>	<b>234</b>	<b>Total</b>	<b>44</b>

(Note) As of March 1961

(Source) Takeuchi A. (1962),

### 5.2 Cluster formation in northern area of Tokyo

In Itabashi Ward in Tokyo, there lived many engineers and skilled workers who had engaged in optical munitions production for Tokyo Kogaku during the wartime period, because Tokyo Kogaku

<sup>7</sup> Kikaishinkokyokai(1977:40)

which was located in Itabashi had been the main supplier of binoculars and other optical products for the Japanese Army's Tokyo Arsenal since its foundation in 1932.

As the company lost its demands after the war, as aforementioned, most of its 8000 employees had to leave out from the company. Many of those who had engaged in binocular production works started their own businesses based on their skills and technology, such as lens grinding and casting metal works in Itabashi.

Then a question arises why another cluster of small binocular makers did not emerge in southern area of Tokyo where Nihon Kogaku was located? Some factors of locating in this particular area in and around Itabashi Ward were as follows.

#### 5.2.1 Area of technology resources

A Tokyo Army Arsenal plant had been operated in Kita Ward (neighboring ward of Itabashi) until the end of the war. For this reason, Tokyo Kogaku located its headquarters and main factory in this area.<sup>8</sup> In Itabashi there had been many small metal processing factories existed from prewar period<sup>9</sup> and not a few unemployed workers with optics related skills lived after the war.

#### 5.2.2 Area of easy access

According to Takeuchi's survey<sup>10</sup>, of the 28 responded assembly factories, 24 chose convenience of purchasing components and existence of other manufacturers in the same

industry as reasons for locating in Itabashi. Also 9 out of 10 component factories considered convenience of product delivery as an essential condition for the location. Once firms gathered in nearby areas, they could get benefits through cooperation, accessing information, complementary production, etc. With this power of clustered firms, binocular manufacturers located and increased in Itabashi and its surrounding area.

#### 5.2.3 Area of earlier development

Considering the cluster development of small binocular manufacturers, it seems that the earlier development of Itabashi than Shinagawa and Ota or southern Tokyo area should be regarded as a crucial factor. Once firms got together in a limited geographical area, they had the advantage of exchanging information and cooperating for the benefit of themselves. This situation yielded a self-reinforcing mechanism of clustering binocular firms in Itabashi observed in late 1940s in the postwar period.

### 5.3 Flexible manufacturing system

Then, what is the relationship of competitiveness and cluster formation in this case?

Almost all of Japan's binocular exports were shipped to the US market which was characterized by volatile demands, particularly in the Christmas season. Manufacturers faced rapid decrease of sales after shipment for Christmas and product prices had to be cut to maintain quantity of sales.

One of the characteristic features of production system of binoculars was the division of manufacturing processes of components by many small and medium-sized firms. Being processed through these firms, components and cover cases were made and assembled into completed

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<sup>8</sup> Seiki Kogaku Kenkyusho (later Canon) also located its initial factory in Itabashi in prewar period, although it moved before the breakout of the WWII to southern Tokyo where the Navy Arsenal and Nihon Kogaku (Nikon) operated in the surrounding area.

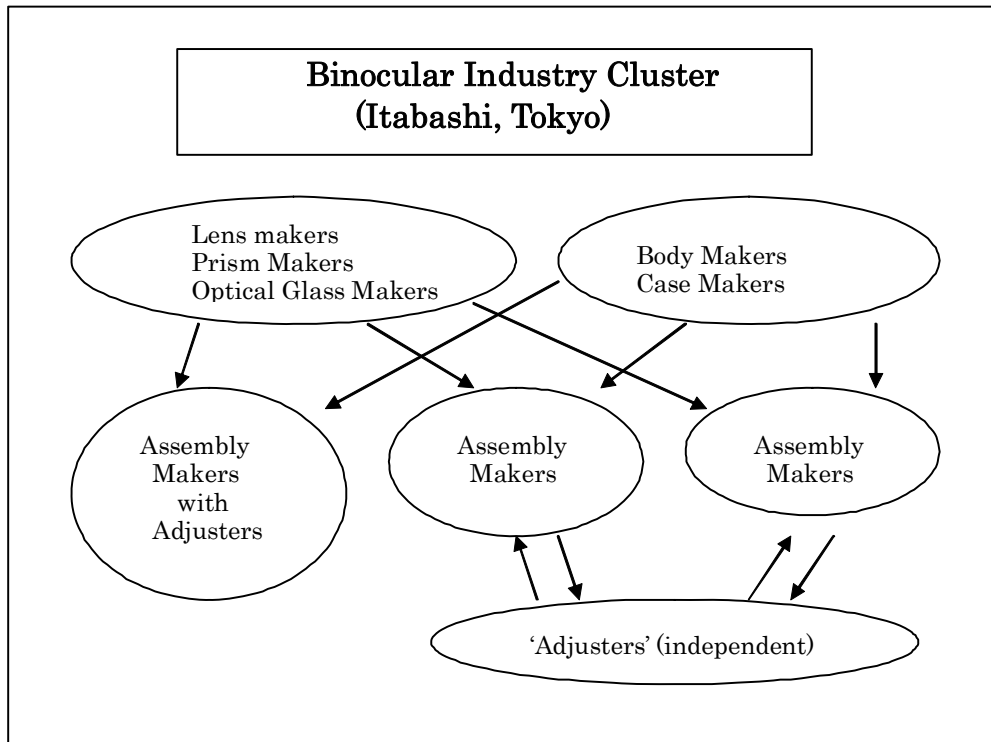
<sup>9</sup> Especially copper processing skills had been developed.(Saito())

<sup>10</sup> Takeuchi(1962:50)

binoculars. This style of production made Japanese binoculars possible to penetrate quickly into the world market at very competitive prices. The style was an endogenously generated flexible manufacturing system.

due dates of components. Assembly manufacturers needed to procure materials for component manufacturers. This internally developed production network system in the cluster could respond quickly to the volatile demands.

Figure 5.2 Image of Binocular Production Networks



Roughly speaking, two main materials for manufacturing binoculars are glass and metals. Processes of the former include grinding and centering of lens, while processes of the latter are such as molding, plating and so on. For each of such processes factories became independent specialized component manufacturers. Skills of manufacturers and their capabilities were well known among firms in the area and assembly makers knew who could make what.

Making a single binocular required more than one hundred processes. For an assembly manufacturer trading with at least 20 to 30 component manufacturers was necessary. Therefore assembly manufacturers had to arrange and control

#### 5.4 Government support for establishing inspection institution

When binocular production began in the postwar period, the Optical Instrument Industry Cooperative inspected voluntarily the members' products to be sold to the PX of the occupation force bases in Japan. This was done by mutual inspection at each manufacturing factory.

After the export of binoculars became possible, the cooperative had inspectors with experienced skills within the organization and started inspection of exporting binoculars for fees in 1950 under the



approval of the Trade Public Corporation<sup>11</sup>. Inspected products by the organization were not only those of members but also of non-members. However, large corporations like Nihon Kogaku made their binoculars inspected at the Japan Telescope Inspection Association which was established with the support of Ministry of International Trade and Industry (MITI). Later the organization as an independent inspection institution became the only authorized organization which could inspect binocular exports under the control of MITI in 1953. At the same time, the Government enacted a strict regulation so that no binoculars could be exported without passing inspection of the authorized institution.

## 6. Conclusion

Product quality and lower prices were two main sources of competitiveness for Japanese binoculars in the postwar period.

Technology, which developed during the World War II, helped maintain quality level of Japanese binoculars made by small manufacturers because most of them had skills and technology experiences of manufacturing binoculars or other optical munitions during the war. Standardized designs of binoculars and rapid expansion of production capability during the war by the Japanese Navy and the Army caused a spillover effect of binocular technology among private manufacturing firms in the postwar period. Moreover, the press-molding method of optical glass processing technology which was developed in the wartime contributed to produce quality lens and prism at inexpensive prices. Thus, the quality level was largely ensured by these inherited technologies and skills.

On the other hand, price competitiveness of Japanese binoculars derived mainly from a flexible manufacturing system of specialized firms which were agglomerated as a cluster in the northern part of Tokyo. Cluster formation of binocular firms could not be realized if there had not been Tokyo Kogaku (later Topcon) and the Tokyo Arsenal of the Japanese Army in the same area, because there had been small factories without having orders and skilled unemployed workers there in the immediate postwar days.

This production system as a network was formed endogenously by cluster members of small assembly and component manufacturers. Assembly makers could make an order of components by one telephone call or go directly to nearby factories. Demands of the product were very volatile as they were dependent on the Christmas seasons in the U.S. market. Facing volatile volumes of demands, a typical binocular manufacturer did not have inventories of products and kept its scale in a small size. Basically they started production upon receiving orders. That was a management style of binocular manufacturers to adapt to change in volume of orders.

As Japanese binoculars showed good performance per cost, they could take high percentage of the imported binocular market in the U.S.. The high cost-performance of binoculars continued owing to lean and flexible manufacturing system of small firms. Thus, competitiveness of Japanese binoculars over other countries continued as an outstanding rank in the world market until early 1980s.

On the other hand, domestically fierce competitive situation made exporting prices of

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<sup>11</sup> "30 -Years History of the Optical Instrument Industry Cooperative" 1980 (in Japanese)

binoculars follow a decreasing trend. Manufacturers reacted to form cartels in 1960s, but the story of development of these cartels is not within the scope of this paper's objective.

In this paper, I stress the importance of heritage of technologies and human networks or social capital for the development of an industry. I have tried to depict this relation by illustrating the case of small binocular manufacturers in Japan.

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### REFERENCES

Kikaishinkokyokai Keizaikenkyusho (Japan Society for the Promotion of Machine Industry, The Economic Research Institute), 1977. *Sogankyo Sangyo no Ayumi* (A History of Binocular Industry)

Kogaku Kogyoshi Henshukai, 1955. *Heiki o chushin toshita Nihon no Kogaku Kogyoshi* (History of Japan's Optical Industry with Special Reference to Military Equipment)

Nihon Kogaku (Nihon Kogaku Kogyo Kabushiki Kaisha), 1960. *Yonjunenshi* (A 40-year History)

Nihon Kogakukogyo Kyodokumiai (Japan Optical Industry Cooperative) 1980. *30 nen no Ayumi* (The 30-year History)

Ohki, T. 1964. *Sogankyo to tomoni 50 nen* (50 years with Binoculars), Kogakusangyo Shinbunsha

Saito, A. et al., *Tokushu: Itabashiku no kogakusangyo* (Special Edition on the Optical Industry in Itabashi Ward) 26/04/2007.

<<http://www.city.itabashi.tokyo.jp/shokou/industry/leading/tokushu.pdf>>

Takeuchi, A., 1962. *Reisai kogyo no sonritsu keitai-Sogankyo kogyo no ricchi-* (The location of Binocular Industry in Japan), in *Jinbun Chiri* (Japanese Journal of Human Geography)14(4), pp.42-54, Jinbun Chiri Gakkai

Notes from an interview with David P. Bushnell 10/07/2007

<<http://www.europa.com/~telscope/bushnell.txt>>