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The Agglomeration of Learned Skillls and the Role of Regional Community

Hisashi Yaginuma

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1. Introduction

It is an already established view since the end of 1970's that the agglomeration of very small factories in Ohta-ward, located in the south of Tokyo, can be seen as a highly flexible production network system. In this paper, keeping this recognition in mind, I will try to reassess the role of this regional community by stressing the diversity of learned skills, the importance of the tacit knowledge, and also the reliable relationship and trust nurtured or embedded in this regional community which reduces the transaction cost and induce the innovation in general. By doing so, we can make it clear how the small factories in Ohta-ward have produced workers with accumulated skills and unique characters arising from the interdependent relationship among them in the community.

The argument in this paper proceeds as in the follows. At first, the agglomeration of small factories in Ohta-ward and its structural characteristics are briefly explained.

How this phenomenon is explained by the logic of economics follows next. We can interpret the meaning of obtaining skills as the process of learning tacit knowledge.

It is suggested that the diffusion and transfer of this learned skills are closely related with the innovations in the regional community.

The pride and artisan spirit of the highly skilled craftsmen working in these small factories are fed through the interactive relation among them in this community. It suggests the importance of the social network in this area.

The 'Ohta-ward Model' based on factors existing in this area gives us a good explanation of this unique and diversified city region. However, the change in the surrounding environment of this region may destroy the network based upon the trust.

2. The Agglomeration of Small Factories in Ohta-ward

2.1 The Brief History of the Factory Agglomeration

In the beginning of Meiji-Era in Japan, Ohta is an area whose main industries are agriculture and fishery such as seaweeds extraction. Only some canning plants and straw working factories are located here. The straw hats are the main export products at that time (S. Okabe and H. Yaginuma, 1978). Lately, several plants and factories located here. But the atmosphere remained quite rural as a whole.

However, the great Kanto earthquake in 1923 brought about the relocation of many factories from the central Tokyo. And the outbreak of Manchurian War in 1931 and its accompanying military demand contributed to the expansion of factories and its subcontractors in this district, leading her as the core of the Keihin Industrial Belt.

The number of factories in Ohta showed a dramatic increase from 1,112 in 1932 to 5,148 in 1941(S. Okabe and H. Yaginuma, 1978).

The defeat of the 2nd World War gave a great damage to Ohta-ward and the number of factories remained about half of 1941 even in 1948 (D. H. Whittaker, 1997, S. Okabe and H. Yaginuma, 1978). As the Japanese economy entered into the high growth period, the industry in Ohta-ward became active once again and the number of factories exceeded the 1941 peak in 1961. The peak of the agglomeration of factories in Ohta-ward comes in 1983.[1] It is the year when Japanese economy appeared as the giant with great trade surplus after she managed to overcome the 1st (1973) and 2nd (1978) oil crisis.

The drastic appreciation of Yen and the resulting low interest rate brought about the 'Bubble.' Japanese economy could not come out the long recession after the collapse of this bubble during the last 15 years.

The most remarkable characteristics of the industrial agglomeration in Ohta-ward are the specialization to metal and machinery industry and the concentration of very small businesses (Table 1) (S. Okabe and H. Yaginuma, 1978, D. H. Whittaker, 1997, M. Seki and H. Kato, 1990).

<Table 1 is around here.>

Today, because of the demand shift occurring from the overseas investment of major manufacturing companies, the massive inflow of competitive foreign products from

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[1] The number of factories at the peak of each business cycle is as follows.

Year	1963	1966	1970	1973	1978	1983
Number	7,556	7,031	7,257	8,893	8,380	9,190

Data are from S. Okabe and H. Yaginuma (1978), Institute of Development and Planning (1994), Research Institute of Small and Medium Businesses (1996).

Accidentally, the number of small factories of Higashi-Osaka, which is also famous for its agglomeration of small factories, showed the peak at the same year (T. Nakazawa, 1998).

China or South Korea, the basic transformation of industrial structure, and the urbanization and the rapid technological change, the number of factories in this region has drastically declined to 6,038 in 1998, the latest available statistics, less than the one in 1963.

2.2 The Diversity of the Agglomeration

The diversity of the factory agglomeration can cope with various kinds of metal-working processes. The diversified chain of processes of each factory in this region is as follows (Table 2).

Almost all the metal/machinery related businesses and factories in this region are specializing into only one of these processes. The most concentrated process is cutting (about 30% of all businesses in this region) followed by sheet-metal processing (8%), stamping (7%), mold-building (7%), and plastic molding (4%). Today, there exist businesses and factories which specialize product-design and R&D, prototype manufacturing, and order-matching (Japan Small Business Research Institute, 1996). In addition, there is diversity of materials such as ferrous and nonferrous metals, ceramics, carbon, glass fiber etc. For each material, different types, shapes, and sizes are processed. The diversity processes in Ohta-ward is quite enormous.

<Table 2 is around here.>

Each material and component gets many different types of processing through the network of factories before returning to the original ordering company. This chain or division of process is not constantly fixed. This is possible because of the potential capability of each factory so that we can extract a necessary parts of the whole their processes and change flexibly the combination of processes accordingly.

This can be named after M. Piore and C. Sabel (1984) as 'flexible specialization.'

To utilize fully the network of factories with diversified capabilities, some third party players are required to match the demand and supply taking into account the requirements and separating the processes into small units and allocating each process to each factory. Factories or craftsmen share their jobs or orders with others, which is called 'Nakama Torihiki (transactions among colleagues or job and order sharing)' (S. Okabe and H. Yaginuma, 1978, D. H. Wittaker, 1997). Also, many intermediaries are specializing in connecting outsiders with insiders or small factories (called 'linking agent' (M. Takaoka, 1998). It is indispensable for them to grasp fully the potential of each factory. The

diversified agglomeration of small factories in Ohta-ward functions as the unique system promoting the friendly competition (called 'Sessa Takuma') and the complimentarity or collaboration among them (called 'Nakama Torihiki').

In the city region there exists lots of diversified needs for intermediate goods with different qualities. By connecting or integrating diversified demand with flexible agglomeration of supply capabilities, the network of factories in Ohta-ward can produce lots of diversified intermediate goods.

S. Okabe and H. Yaginuma (1978) points out that small factories are trying to process prototype products and or small-lot products and diversify to new areas different from their traditional businesses (M. Seki and H. Kato, 1990).[2]

2.3 The Agglomeration of Learned Skills

In this region, most small factories have only standard and general-purpose machineries (Institute of Development and Planning, 1994). The key to understand the contradictory phenomenon of the diversity of the goods produced and the uniformity or general-purpose machineries used is the skills of the craftsmen in these small factories. They are accumulated and embodied within workers or craftsmen through long years of working experience. We call them as learned skills.

T. Ozeki (2000), as a lathe man, tells us about many insightful aspects of the nature of learned skills. Craftsman with learned skills can imagine in advance the final state of the works or materials brought in. He can understand the whole processes of metal-working and check the point of attention by himself. Furthermore, he makes clear about the types of blades and tools to be used or made, and the speed of cutting.[3] T. Ozeki (2000) expresses this capability as 'the eye to look into the depth of jobs.' It is a different capability from the dexterity or cleverness in handling lots of works.

Various materials give sounds when they are cut. The sounds differ depending on the types of materials, the shapes of blades, rotational speed of machines, movement of holders, and condition of machines etc. Skilled lathe man must understand the situation by listening the sounds it produces. In addition, even from the color and shape of chippings

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[2] In S. Okabe and H. Yaginuma (1978), that the per-capita value-added, wages and the percentage of factories with original products and patents are higher in Ohta-ward than the national average for small factories. Research Institute of Small and Medium Businesses (1996) points out even in 1994 the per capita value of shipment in Ohta-ward is higher than the other region with large agglomeration of metal/machinery industries.

[3] When the works are brought in, hand-written rough drawings called 'Manga,' are handed in. Skilled lathe man should imagine the whole steps of metal-working processes based on Manga. The example of 'Manga' can be seen in H. Nukada (1998), and T. Ozeki (2001).

the must infer the appropriateness of the state of work and the ways of cutting.[4]

In some cases he scrapes the part not directed in the figures or drawings, called 'Sute-biki (scraping to be discarded)' and in the case of mold-building he draws the irrelevant space of the die, which is called 'Sute-shibori (drawing to be discarded).'

These are highly creative activities, without which the final products cannot be properly completed (T. Ozeki, 1998). The diverse capability of craftsman has displayed originality in the fields of industrially advanced products. Many examples are shown in Table 3 which became possible only through the effort and creativity of the small factory in Ohta-ward (T. Ozeki, 1998).

<Table 3 is around here.>

Many big firms and various business people visited those factories in Ohta-ward through this 'hidden road of jobs' (T. Ozeki, 2000) since 1950's (D. H. Whittaker, 1997).

3. The Economies of Connectedness and the Externalities

3.1 Division of Labor and Adjustment Cost

The small factory network in this region as a whole does not engage in the production of standardized and homogeneous goods in large scale. 'Economies of scope' (W. J. Baumol et al., 1988) refers the cost advantage of producing several goods in one organization rather than in different multiple organizations. This fits well to the diversification of big corporations but not to the network of small factories.

A. Smith's 'division of labor' is concerned about the allocation of labor in one factory. It can explain the existence of the network of small factories each specializing into one of the metal-working processes and connected with each other through the chain of processes.

Theses discussions refer to the existence of the 'economies of specialization' resulting from the differing economies of scale for each process related. Information technology reduced the connecting cost of business activity and it enables the connected bundle of the capabilities of small businesses more efficient than the activity of single

[4] He has lots of words to express the delicate differences in the process of metal-working. He uses words like 'cut,' 'drill,' 'crumple,' 'saw,' ' lick,' 'dredge,' 'dig,' 'bite,' 'scrape,' 'scoop' (T. Ozeki, 2000).

integrated business firm. K. Miyazawa (1998) calls it 'economies of connectedness.'[5] This argument is most suitable in explaining the division of labor process existing in Ohta-ward.

It is natural to include the accompanying adjustment activity connecting many resources and businesses as an independent factor of production. The benefits to utilize the agglomeration of small factories for outside clients and for inner factories to exist, the adjustment cost to link and match the orders between client and factories or among factories and also the adjustment cost to transfer and exchange information and know-how among them is required to be quite low.

The important point in discussing adjustment cost is the loyalty or trust mentioned by K. J. Arrow (1974). He describes loyalty or trust as 'the goods which cannot be purchased in the market but it makes economic activity efficient once we get it.' He does not refer how this loyalty or trust goods are constructed. However, trust goods have a similar characteristic as of capital. Through the improper maintenance or excess utilization and also by the sudden crisis or destruction of human relationship, the stock level of loyalty or trust will be decreased. On the other hand, as far as the proper relationship among the participants is kept continuously, the level of loyalty or trust are maintained and utilized in the future for the benefit of the parties concerned.

In the first place, loyalty or trust is defined as 'the behavior to expose oneself to risk of deceit by others with the expectation of no-to-be-deceit by others' (T. Yamagishi, 1998, B. Nooteboom, 2002). To obtain the loyalty or trust one needs to establish his or her reputation through assimilation to regional communities and cultures, conformation to the qualifications and rules in many professional areas, maintaining loyalty or commitment to partners, and training by way of learning etc. The loyalty or trust thus established lowers 'the relational risk' such as the hold-up problems accompanying the relation-specific investment and spillover or diffusion of information and finally reduce the transactions cost or the adjustment cost (B. Nooteboom, 2002).[6]

According to H. Nukada (1998), there are two types of 'port of Entry' (C. Kerr, 1954) in Ohta-ward. In the first step newly employed worker engages in only low-grade and peripheral jobs and only in the second step he is allowed to join the core shop floor by his established trust.

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[5] H. Yginuma (1995) argues the necessary condition for the economies of connectedness. It requires the cost function to satisfy 'super-additivity.' This is just the opposite condition of 'sub-additivity' necessary to hold for the economies of scope discussed in W. J. Baumol et al. (1988).

[6] The review of the positive analysis of the effect of trust on the business transactions are shown in B. Nooteboom (2002). He confirms that the existence of trust strengthens the business transactions through several channels in the case of EU and Japan.

3.2 Geographical Agglomeration and it's Externalities

The discussions above do not necessarily explain enough about the agglomeration of diversified small businesses in some particular regions like Ohta-ward or Higashi-Osaka. We require other conditions such as the transportation cost in moving the resources for business activity and the benefit of face-to-face activity for information exchange and adjustment in addition to the economies of specialization and the economies of connectedness. This consideration takes us closer to the external economies of geographical agglomeration.

A. Marshall pointed out the existence of this external economies of the 'Industrial Community' or 'Industrial District' (Table 4).

<Table 4 is around here.>

The Marchallian geographical externalities are supported by several positive studies.[7]

V. Henderson et al. (1995) classify different type of externalities in urbanized region as in Table 5.

<Table 5 is around here.>

The recognition of the role of spillover and diffusion of technology or knowledge as the source of innovation is found in the extended version of geographical externalities. This recognition is persuasive to understand the situation of Ohta-ward where small factories exchange various information and ideas on market and technology and making effort to be friendly rival and competitor with each other. The concept of the dynamic externalities is to look the origin of information accumulation formed historically from the past and it affects the development of the city afterwards. We can find some similarities with the path-dependence by P. A. David (1985) and the positive feedback by B. Arthur (1994), both of them stressing the role of historical path affecting the future course of the industry and society. There are many studies on the two types of geographical externalities most popularly in the U.S.[8]

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[7] G. Dumais et al. (1997) analyzed the location decisions of new factories in the U.S. and found the proximity to clients or suppliers is not important. But the spillover effect of knowledge and the thick layers of skilled labors are very important.

[8] G. Dumais et al. (1997) analyzed the industrial agglomeration in U.S. city regions and confirmed the existence of

The diversity of intermediate products and skilled labors has been formed historically and many factories are connected with each other based on the trust formed through the long years of transactions. In this sense it has the same aspect of the dynamic externalities just discussed.

4. The Diffusion and Transfer of the Learned Skills and Tacit Knowledge

4.1 Learned Skills Based on Experience

H. Nukada (1998) considers learned skill separately from craftsman's technical skill. A worker who can work in many different ways utilizing his rich knowledge about the property of machines and materials is only a capable skillful technician. Learned skill requires the flexible capability to cope with irregular, non-standard, and unexpected problems in the working processes. As is stressed by T. Ozeki (2000), the difference between workers with learned skills and workers with multi-job skills lies whether hi is capable to take a holistic and broad approach to decide the se-up for the whole metal-working processes.

K. Odaka (2000) made a distinction between craftsmen in the traditional sense from workers in small factories. The traditional craftsmen are those who fit into the conditions in Table 6 according to him.

However, T. Ozeki (1997) recognizes that the workers with learned skills are the craftsmen. Many workers with learned skills remaining in Ohta-ward have been thinking themselves as craftsmen full of pride and artisan spirits in the traditional sense even after the high growth period (see T. Ozeki, 2001). In many cases they wish to become independent and have actually obtained a high level of discretion when they engage in the production of prototypes and small lot components. They are just the craftsmen defined by K. Okada. The world of traditional craftsmen continued to exist as the world of workers with learned skills in this region.

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urbanization economies and Jacobs urbanization economies. V. Henderson et al. (1995) found that new industries grow in the central city area where there exist Jacobs urbanization economies. On the other hand, matured industries come to the scattered small cities where they can enjoy MAR localization economies. De Lucio et al. (2002) studied the case for Spain. In their analysis MAR localization economies is confirmed. The findings by G. Duranton and D. Puga (2000) on the relation between cities and industrial diversity based on U.S. data are that large cities tend to be highly diversified and tend to show high degree of urbanization economies and Jacobs urbanization economies. On the other hand, in small and medium cities localization economies and MAR localization economies are popular.

<Table 6 is around here.>

A worker with learned skills has to acquire the capability to cope with irregular processes and find new ideas for the working processes, to advise and change the materials or designs and/or figures, to identify and coordinate the collaborations with and the inter-factory division of labor among the colleagues. After reviewing the factors of successes or failures, he tries to reset his own rules and norms to avoid failures and to continue to learn in such a way as learning by doing, by using, by interacting, by learning, by asking etc. Learned skills cover not only technological learning, but also cover far-reaching experiences in human relationships and business management. Thus the learned skills are embodied in the body of workers.

Almost all of the orders brought to factories state only about the final image of the works. Workers with learned skills can imagine the total arrangements and processes, required tools and subsidiary steps for the best and suitable disposition based on their know-how without any use of manuals and outside instructions.

The most suitable steps and works to be done in each phase are drawn form the implicit and embodied memories of the workers fed through the experiences. The works are executed through the joint and close cooperation between their hands and machines connected. Feelings of integrated movement of hands and machines are transmitted through his arms and fingers. It this way works are processed by referring to the memories in his body at the same time.

When he cannot complete his works by himself because of the lot size or delivery time, he must ask his colleagues to join or cooperate. To decide whom and which part of the processes to ask hi should take into account both the level of his colleague's skills required for the jobs and his trustworthiness. This decision is done by the Judgment accumulated through business relationship and exchange of skills and ideas in the past. Those judgments are knowledge embodied and memorized internally within the body of each worker with learned skills. It can be codified only to a limited degree.

In the first stage toward learned skills, workers have to learn the basic metal-working processes under the apprenticeship or supervision of their masters just as in the world of traditional craftsmen. The learning through instructions or manuals is no sufficient. They have to internalize learning by way of imitating the works and operating the machines by hands within their body. This is the learning process through experience and embodiment acquired by attending at each special occasion with the accompaniment

of someone.

4.2 The Transfer and Spillover of the Tacit Knowledge

The totality of diverse experiences implied in learned skills is deeply connected with the procedural memory regarding how to combine the various uncodifiable knowledge succeeded and accumulated continuously within the body acquired at each actual situation. Such knowledge is embedded in the special memories and tends to become 'tacit knowledge' (B. Nooteboom, 2002). M. Polanyi (1996) says that a man can know more than he can tell. The totality of experiences and memories of workers with learned skills within their body as the 'procedural knowledge' (M. Itoh, 1997) mastered through the long years of working experience bears fruits as 'the tacit knowledge' or wisdom knowing more than they can tell.

According to M. Polanyi (1996), there is not anything but our human body which experiences incessantly the world outside of us. We sense the world directly through our 'adjacent terms' or contacting organs like sense of sight, hearing, touch, smell, and taste etc. and integrate and restructure our experiences actively toward the whole understanding or 'far-reaching terms' to utilize our skills or imagine the total processes lying ahead. The capability of this active integration composes the indispensable part for our recognition of the world as the implicit force. This implicit force which integrate our experiences in the form of tacit knowledge or wisdom can be understood and transferred as knowledge only when we as an observer dwell-in the motion of those with implicit forces.

Knowledge can be divided into codifiable or describable knowledge and tacit knowledge. However, tacit knowledge is an indispensable factor to understand and interpret codifiable or describable knowledge and to re-integrate it toward the new far-reaching terms. This complementarity between two types of knowledge, suggested by B. Nooteboom (2002), is the key to the understanding of the word as we recognize it. The complementarity between describable knowledge and tacit knowledge in each layer of knowledge assures the raison-d'etre of tacit knowledge and continues to exist during the process to ascend the ladder of the layered knowledge.

The learning process necessary to the formation of learned skill has a characteristic of sunk cost. It is difficult to recover the cost even if his skills are applied and transformed to different jobs. Therefore, those with learned skills have the relative advantages in staying in their own established jobs because of this difficulty to recover the

cost. This shows naturally the path-dependence effect defined by B. Arthur (1994).[9]

The learned skills produced by sunk cost decrease the adjustment cost of coordination. They also contribute to absorb, diffuse new innovations and ideas and to improve them with some destruction of the established jobs and technologies. It is well known theoretically and positively that the spillover effect of information and knowledge is vital to the innovations occurring within urban area.[10] The possibility of new innovations will be increased with the existence of learned skills and its accumulation as is already mentioned.

According to J. R. L. Howells (2002), Knowledge is diffused and transferred through several channels shown in Table 7.

<Table 7 is around here.>

The uncodified format of spillover, which we cannot find in Table 7, is the process of learning itself toward the completion of learned skills and utmost important form of the transfer or spillover of tacit knowledge or wisdom. Tacit knowledge is indispensable in interpreting and understanding describable knowledge usually in codified form. Especially in the case of innovation where uncertainty is high and knowledge or interpretation cannot be shared among the related participants, to promote sharing, harmonizing and integrating tacit knowledge or wisdom among them becomes the key for success (B. Nooteboom, 2002).

5. Work Incentives and Social Network

5.1 Work Incentives and Regional Community

The long period necessary for the completion of learned skills requires so much cost. Applying the human capital theory of G. S. Becker (1993), the reason of long years learning through education and training with high cost is the monetary return such as the future increase in productivity or wages. A worker with learned skills can earn higher income compared with a worker of lower skills. However, the workers with learned skills

[9] M. Ohtaki (1994) proves strictly that the sunk cost is the cause of the path-dependence or hysteresis.

[10] See note 7. J. Simmie (2002) argues that the concentration of innovations in South-east urban region of England can be attributed to the spillover of localized knowledge and the international transfer of knowledge. C. J. Simon et al. (2002) reports the importance of the effect of the spillover or diffusion of knowledge produced in urban regions.

in Ohta-ward have quite different ways of thinking.

The examples from T. Ozeki (1997, 2001) give us some suggestions about this.

- When I polished the lens with the accuracy of micron level and found the expected result by measuring with the standard, it is a great excitement to me.
- I am always ashamed of carelessness or abandonment of the jobs asked by others more than failures in business management.
- A craftsman must complete the product without any personality. But we call him as a worker with learned skills because he demonstrates his own creative characters until the final moment of accomplishment.
- When he faces a seemingly difficult or burdensome task, he hesitates at first. But his face brightens with his eyes full of expectation of joy as if a hawk looking into his catch.
- I feel that I got some progress only when I invented necessary tools for work and utilized them. The important sense of metal-working or creativity can only be obtained from this experience.
- The implicit desire to do good jobs or make better products is quite different from the business oriented economic activity in its nature.

From these examples appears the belief of the workers with learned skills, finding the genuine delight in his job as his lifework, thinking his job as intellectual and creative and full of pride, and paying continuous effort as the good to be pursued. Their self-discipline or lifestyle may be the result of this satisfaction of accomplishment not attributable to monetary calculations as in the human capital theory. To a craftsman or a worker with learned skills, high-quality learned skills, broad human network supported by the mutual trust, intellectual creativity, enthusiastic desire for his job, respect for the personality, and independence from each other are utmost important. These characteristics can be summarized in a word as the artisan spirits or craftsmanship.

This sense of craftsmanship is fostered and nurtured within the 'industrial district' according to A. Marshall. The characteristics of a worker with learned skills have been succeeded, widened and deepened in a place or regional community consisted of his seniors or colleagues with common work-ethics. On the other hand, each worker interacts with each other to master the craftsmanship and affect fostering the workers with common characteristics further. We can find the interactive situation originating from individual workers and the situation originating from region or community. The latter channel can be

interpreted as the effect coming from regional culture. New participants to this community can easily acquire these characteristics and enjoy a great benefit in his jobs and businesses. It is a phenomenon described as the 'increasing returns' or 'self-reinforcement' effect of a social phenomenon referred to by B. Arthur (1994). As the result of this interaction, a community with unique characteristics is constructed cumulatively and path-dependently. Along such path the workers with learned skills are reproduced continuously. The atmosphere filled with craftsmanship unique to a region can be said as a regional public goods and plays an important role in the forming and maintaining the characteristics or culture.

5.2 Social Network as a From of Institutional Capital

R. Putnam (1997) stresses the role of social network with others, norms and trust arising from the social life in the regional community as the social capital producing mutual cooperation among the people (J. Sobel, 2002). As economists, K. J. Arrow (2000) and R. Solow (2000) are rather critical in defining the social capital as capital. H. Uzawa (1994, 2005) also stands afar from this concept. His original concept of Social Common Capital is classified into three categories; natural capital, social infrastructure, and institutional capital. According to H. Uzawa (1995), T. Veblen understands the institution including the organization, customs and psychological conditions. Intangible assets such as language, traditions are classified into the cultural capital, which constitutes a part of his institutional capital. D. Throsby (2001) defines cultural capital as another form of capital. In the analysis of innovative community such as Silicon Valley, the regional social networks play an important role (A. Saxenian, 2000, E. J. Castilla et al., 2000, D. Fornahl, 2005).

Putting aside the theoretical argument about the definition of social capital, we understand social capital as social network or informal place where people contact and interchange with others to master norms or ways to behave required to each person there, and rules or institutions for that purpose. Trust or reputation is the service provided by it.

Ohta-ward is characterized as a system helping each worker with learned skills acquire tacit knowledge through the contact, learning, and transactions with his colleagues. It is also a system or a place reproducing them[11] the wholeness of their experiences can be mastered from the social network in the regional community and the bundles of manners

[11] R. Florida (2005) stresses the importance of the characteristics of a place as the innovative engine of that region. A place with high degree of tolerance or diversity induces talented people who are the sources of regional innovation. Such a place can have a regionally specific institutional or cultural capital in the sense of H. Uzawa.

and rules there. This regional social network enables for each worker to accumulate easily his skills and to obtain the convenience of transactions with others. By applying the concept of social network or capital, we can identify clearly the implications of the reproduction of the learned skills and the transaction based on trust or reputation. Now we can say that Ohta-ward with its high concentration of workers with learned skills and its regional social network accumulated and developed its worker's unique learned skills and accompanying trust through the interactive learning process between each worker and regional community. The artisan spirit of the workers with learned skills and their tacit knowledge deepen the mutual relationship among them, 'bonding' in the word of R. Putnam, and widen the opportunities of contact with outside world through lots of personal channels, 'bridging' in the word of R. Putnam.

They contributed to raising their specialization level to much higher dimension and maintaining its unique and disciplined regional community.

6. The Development of Diversified City and the Change in its Environment

6.1 Ohta-ward: As a Diversified City

G. Duranton and F. Puga (2001) analyses a model where two types of cities exist. The diversified cities are cities with incubation functions where lots of prototype producers are operating and related new business firms are constantly emerging. The specialized cities are consisting with mass production firms transferred from the diversified cities because of their success there.

Based upon the findings of the unique characteristics of the agglomeration of small factories and workers with learned skills in Ohta-ward, the following four points can be added into their model.

1) Accumulated tacit knowledge by individual workers with learned skills within diversified cities.
2) Satisfaction from and strong artisan spirit of the workers in acquiring new idea and adding them to their stock of tacit knowledge.
3) Strong complementarity among factories with their differing economies of scale and proximity.

4) Trust or loyalty arising from the regional social network.

The revised model of G. Duranton and D. Puga (2001) let us male possible to compare our conclusions with theirs.

1) The decline in the production cost and increase in demand in the diversified city will provide the increased number of complementary factories and employees.
2) Higher level of loyalty or trust will promote the diffusion, transfer and exchange of information and ideas. The resulting advancement of technologies and innovation will be more promoted.
3) Congestion will arise. But its restraining effects may not be strong enough to limit the size of diversified city.
4) The social network or institutional capital embedded in the region will form higher trust or loyalty. It will contribute more in forming and maintaining the learned skills or tacit knowledge.
5) More successful firms will appear in the diversified city and its incubation function will be strengthened.

The Ohta model will give a clearer explanation about the phenomenon of the massive agglomeration of innovative firms with high degree of specialization reflecting the bonding among factories. Workers have strong incentives to invent new ideas and the learned skills will be reproduced through the learning processes embedded in this region.

6.2 The Effect of the Change in the Environment

As is already referred to, the number of small factories in Ohta-ward has dramatically decreased in recent years to the level of almost 40 years ago. Many factors have been working behind this long-term trend. The following four factors should be noticed.

1) Shift of the industrial structure from secondary to tertiary sectors.
2) Globalization of the manufacturing industry.
3) Urbanization in the regional community.
4) Technological progress in the field of IT.

These factors will add another revision of the above conclusions as in the follows.

1) The demand for the prototype will decline because of the shift in the industrial structure and overseas investment.
2) Increased competition will decrease the advantages of prototype production in the diversified city.
3) Succeeded firms will relocate their production bases more easily to the mass-production city in the outside world.
4) The urbanization will work as a negative factor to the network operation and innovative activities in this region.
5) The development of IT will strengthen the economies of connectedness. It will promote the prototype production. On the other hand, it may reduce the opportunity of local contact among the factories and clients and have a negative impact on the network in the region.

These revisions can explain the declining trend of the number of small factories in Ohta-ward. However, more fundamental process 1 is under this phenomenon. That is the decline in the stock of the accumulated learned skills and the stock of social network or institutional capital in this region. This process will cause long-term decline of the strong complementary relations among small factories network and its innovate on activating function.

The development of information technology may curb this trend. However, it may become a rod connecting a region with more remote and different regions for another development. According to T. Yamagishi (1998), there is possibility that the trust to others will be united with information technology to the release of trust to establish a new social network.

7. Epilogue

We tried to capture the unique aspect of the agglomeration of small factories in Ohta-ward focusing on the accumulation of learned skills and tacit knowledge, flexible specialization system based upon mutual trust, and the regional social network fostering mutual trust and norms or characteristics of the working people there.

It was shown that small factories in Ohta-ward specializing into some unit of working process have been producing highly advanced products through their networks. It

is also confirmed that the highly diversified and advanced agglomeration of learned skills supported this phenomenon.

The agglomeration of small factories in this region can be explained by the economies of connectedness and the dynamic externalities arising from information exchange and socialization. The loyalty or trust as a factor to reduce the adjustment cost and the tacit knowledge arising from the accumulation of learned skills and its diffusion are the important factors lying behind.

The incentive of the factory workers in this region lies strongly in the process to realize their own ideas and obtain their satisfaction by it. This character has been reproduced from the interactive relationship between individuals and regional community.

Ohta-ward can be explained as the diversified city with incubation functions. However, the long-term change in environment of this community is shown to have a negative impact. Information technology can have both positive and negative effect. By looking into the agglomeration of small factories in Ohta-ward, we can recognize the importance of the accumulation of tacit knowledge and its diffusion and the role of the social network nurturing the community specific characters or norms. The construction of regional community based on the bonding and collaboration with new industries and residents will be in the future problems to be solved in this community of Ohta.

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Table 1: The Share of Metal and Machinery Factories and Small Businesses in Ohta-ward

	1960	1980	1990	1998
Metal and Machinery	77%	79%	84%	78%
Very small Businesses	42%	79%	80%	82%
Total Sum of Businesses	4,987	8,307	7,860	6,038

(Note) 1. Data are from D. H. Whittaker (1997), Institute of Development and Planning (1994), M. Seki and H. Kato (1990), and the report 'Industry of Ohta-ward'.

2. Metal and machinery includes Iron and Steel, Non-ferrous Metal, Metal Products, Industrial Machinery, Electric Machinery, Transportation Machinery, and Precision Machinery.

3. Very Small Businesses means the number of employees under 10.

Table 2: The Classification of the Processes of the Factories in Ohta-Ward
(Arranged from the Figure by M. Seki and H. Kato, 1990)

Process or function	Examples
Materials	iron & steel producer, nonferrous metal producer, trading company, recycling company
Molding	sheet-metal processing, welding, stamping, minting, drawing, powder metallurgy, die-casting, mold-building
Clearing	metal-working (cutting, grinding, shaving), stamping, heat-treating
Finishing	surface-processing (plating)
Assembling	plastic molding, circuit board, sub-assembling (parts, painting)

Table 3: The Examples of Advanced Products and Components Produced in the Small Factories in Ohta-ward

Ex.1	Scraping the rotor for automobile engine Solution is to scrape rotor embedded in low-melting alloys and melt away alloys later.
Ex.2	Processing the stainless mesh case to store electric parts and systems under the deck of the bullet train Idea is to solidify the case with Japanese traditional paper and process with melting later.
Ex.3	Drawing the head cover or fairing of the H2 rocket Traditional spatula drawing skills are used to the accuracy of 30 micron by finger touch.
Ex.4	Grinding non-spherical lens made of glass with high accuracy Idea is to invent a special tool to grind non-spherical lens with high accuracy of 10 micron level.
Ex.5	Developing a mold for the cover of a can which does not hurt the fingertip New idea to introduce S-structure to the cross-section of the cover is the key for success

Table 4: Characteristics of the Geographical Externalities Pointed out by A. Marshall (by P. Krugman, 1991)

1)	Large market for labor with highly specialized and diversified skills.
2)	Provision of cheap and diversified non-traded inputs by the supportive industries.
3)	Facilitation of innovation through regional diffusion of technology and new management style.

Table 5: Static Externalities and Dynamic Externalities

Static Externalities
"Localization Economies"
Benefits to firms from the local agglomeration of the same industry.
Cities tend to specialize into its own industry and form small or medium-size cities.
"Urbanization Economies"
Benefits to firms from overall local urbanscaleand diversity.
More diversified and larger cities are formed.
Dynamic Externalities
"Marshall=Arrow=Romer (MAR) Localization Economies"
Benefits to firms from accumulated knowledge associated with ongoing communications among local firms in the same industry.
Small and medium-sized cities with the persistent agglomeration of same industry tend to be formed.
"Jacobs Urbanization Economies"
Benefits to firms from accumulated knowledge or ideas associated with historical diversity.
Larger cities with the accumulation of diversified skills and technologies and also with the development of new industries tend to be formed.

Table 6: The Characteristic Conditions of the Traditional Craftsmen

1)	He is the owner of tools or machines and quite independent of his client.
2)	He has the socially established reputation of his own skills.
3)	His skills are accumulated and embodied in his body.
4)	He has a high level of discretion about his job.

Table 7: The channels of Knowledge diffusion[12]

1)	Intended and codified forms of spillover Ex. patents, patent citation, manual
2)	Intended but largely informal knowledge spillover Ex. membership of learned societies or industry associations or regional agencies
3)	Unintended and informal knowledge spillover Ex. departure of key scientists and engineers, informal know-how sharing

[12] The classification is too simple. Strictly, the combination of intended and unintended transfer, codified and non-codified format, formal and informal channel, for two types of knowledge will give us 16 cases.