A Study on Environments of *Industria* and *Artigianato* for Innovative Industries by allocation analyzing of the Knowledge Exchanging Place[1]

Kiminori Nakazawa[2], Valentina Orioli[3], Kazuo Mitsui[4] and Takeshi Sakamoto[5]

ABSTRACT

This research evaluates environments of workers of *Industria* and *Artigianato*, by allocation analyzing of places of knowledge exchange, such as *Cafés* or *Bars,* from the view point of developing new innovative industries of the 21th century.

Many local governments all over the world take measures to develop innovative industries, to bring an economic deadlock to an end[1][2]. But now most companies demand a role as factory to overseas, so overseas production ratio is the best ever. Preparing for environments of new innovative industries is an urgent priority. “Innovation” is sending a certain competitiveness product based on a new technique and idea off in the market, and giving a big impact in the economic society. It is said that accumulation of the innovation type industry needs knowledge exchange of workers of various types of industries in constant space. For example, in the Silicon Valley in U.S., there has been arguments about the innovative start up at all of the cafe in an area every day.

So this research, focusing *Industria* in suburbs and *Artigianato* in center of the city of Bologna and Tokyo, Japan, aims to evaluate environments of workers by allocation analyzing of *Café* or *Bar* as places of knowledge exchange for innovative industries. The analyzing is done by computer simulations by own making programing with geographic information system and several grid data such as land use, architecture shape and point of *Café* or *Bar*.

Within walking distance of both of *Industria* and *Artigianato* in Italy there are a lot of *Cafés* or *Bars* compared with Tokyo. In case *Bar or Café* are the place for knowledge exchanging, it is established that they are allocated to conducive to revitalize innovative industries. Giving co-working function like Co-Working Place to the *Café* or *Bar* with high accessibility leads to revitalize innovative industries more.

Key Words: Industria, Artigianato, Innovative Industries, GIS

1.INTRODUCTION

1.1 Background and Study Purpose

Nowadays most companies in developed countries such as Italy or Japan demand a role as factory to overseas, so overseas production ratio of the countries is the best ever. Under such circumstances, the part of Italy called “the third Italy”[6] for new innovative industries is attracting the most attention now, while developed countries have problems of the hollowing-out of the economy and industry. By referring to “the third Italy”, many local governments all over the world take measures to develop innovative industries, to bring an economic deadlock to an end.

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[1] This research is based on the research work by Kiminori Nakazawa as visiting scholar and Prof. Valentina Orioli at University of Bologna (01.03.2016-28.02.2017)

[2] Associate Professor of Space Design, Industrial Technology, Nihon University, Japan - kiminori.nakazawa@nihon-u.ac.jp

[3] Associate Professor of Urban Design, Department of Architecture, University of Bologna - valentina.orioli@unibo.it (corresponding author)

[4] Professor of Informatics, Industrial Technology, Nihon University, Japan

[5] Mayor of Itabashi Ward of Tokyo, Japan

[6] Which corresponds to the Regions of central and northeastern Italy

So this research, focusing *attività industriali* in suburbs and *attività* a*rtigianali* in the center of the cities of Bologna and Tokyo, Japan, aims to evaluate environments of workers by allocation analyzing of *Café* or *Bar* as places of knowledge exchange for innovative industries. The analyzing is done by computer simulations by own making programming with Geographic Information System and several grid data such as land use, architecture shape and point of *Café* or *Bar*.

1.2 References and Value of the Study

A lot of the past researches in fields of Italian industries exist in the economic study fields in Japan [3][4]. They all focus the north part of Italy leads innovative Italian economy, and suggest the ideal situation for developing new industries in 21th century.

This research considers the land use value of coastal zone from the view point of allocation of industries.

The authors of this research have explained that there are the differences of land use value between inland zone and seaside zone in which had unused lands, because of differences of allocation pattern of land uses[5][6][7]. And this research focuses industrial units, and environments of workers of *industria* and *artigianato*, by allocation analyzing of *Café* or *Bar* as places of knowledge exchange from the view point of developing new innovative industries of the 21th century.

1.3 Flow of the study

The first half of this research considers about current situation of *industria* and *artigianato* of *Comune di Bologna*, industries of Itabashi ward of Tokyo, Japan. The latter half of the research considers about environments of innovative industries by allocation analyzing of *Café* or *Bar* as the place of knowledge exchange in target areas.

2.RESEARCH METHODOLOGY

2.1. Target Area

This research targets *Comune di Bologna* in the northern part of Italy (**Fig.1**), Itabashi Ward of Tokyo and Chiba City in Tokyo metropolitan area, Japan, for comparison (**Fig.2**).

Comune di Bologna is innovative industrial city that has population of 388,567, area of 160.86 km^2. Itabashi ward of Tokyo is one of 23 ward of Tokyo metropolis, that has population of 561,916, area of 32.22 km^2. Chiba City in the east side of KEIYO Industrial Zone that has population of 961,749, area of 272 km^2.

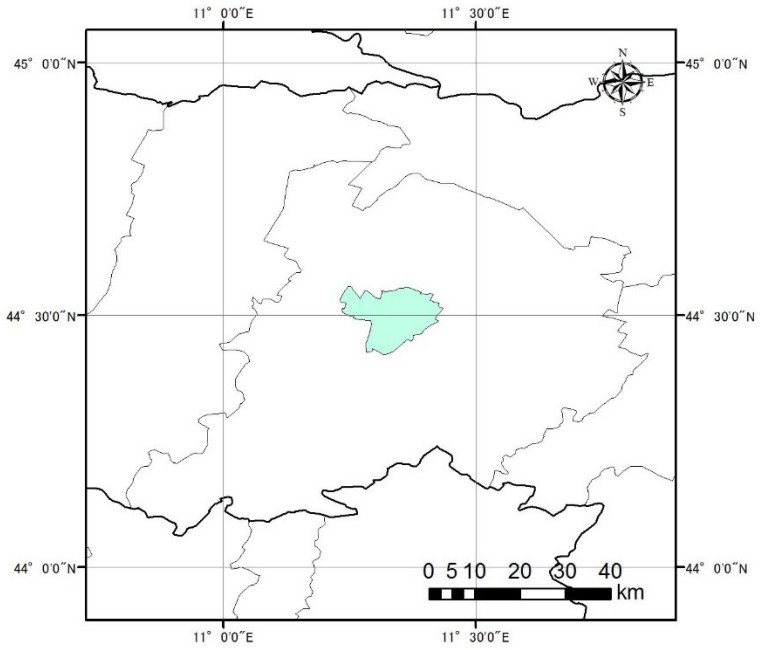

Fig.1 Target Area/Bologna

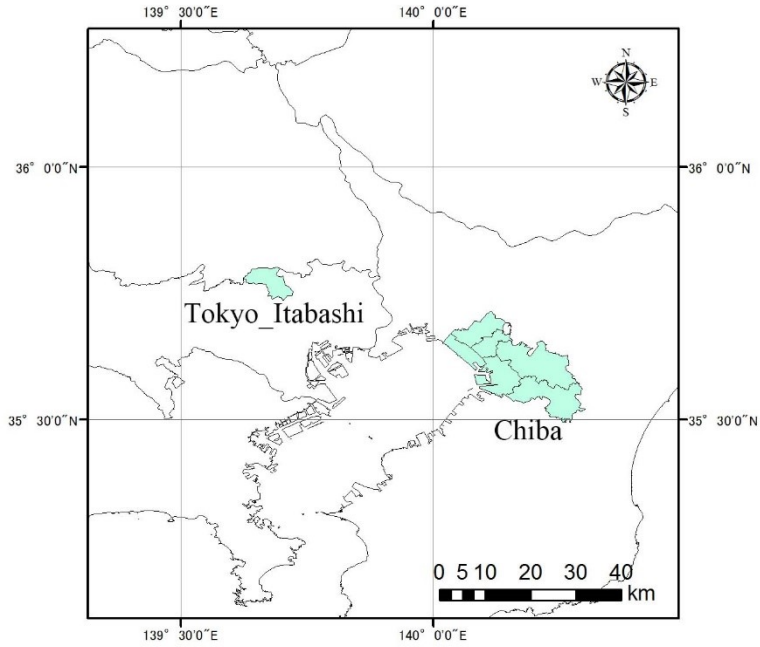

Fig.2 Target Area/Japan

2.2 GIS and Data

Data of Bologna area in this research are based on Web GIS system by municipality of Bologna, and Corine Land Cover 2000 raster data [8] by European Environmental Agency, Administrative area data by Global Administrative Areas [9]. Digital map 5000 LU Surface by Geographic Information Authority of Japan, Administrative area data by ESRI Japan are used as Japanese target in this research. All data are analyzed by ESRI ArcGIS10.3.1 and original programs by Visual Basic.

2.3. Innovation

This research defines "innovation" as to give the society big impacts by providing new products with new technology. It is said that accumulation of the innovation type industry needs knowledge

exchange of workers of various types of industries in constant space [10][11]. For example, in the Silicon Valley in U.S., there has been arguments about the innovative start up at all of the *Café* in an area every day. So it is necessary to arrange environments with considering the connection of factories to urban districts for innovative industries.

2.4. Sensing Knowledge Exchanging for Innovation

As mentioned previously, it is said that innovative industries need knowledge exchange of workers of various types of industries in constant space. So this research proposes the knowledge exchanging index by computational simulation shown in **Fig.3**.

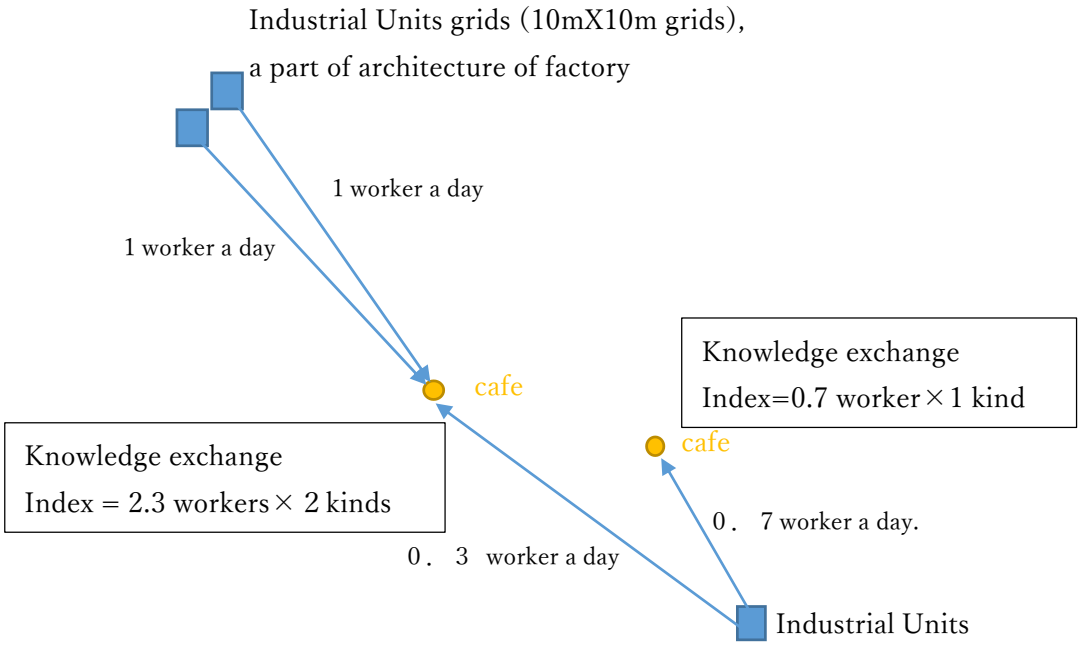

Fig.3 Model of exchange of knowledge in café within walking zone from Industrial Units. Square symbols show industrial unit grids, a part of architecture of factories.

The Knowledge Exchanging Index is evaluated by multiplying workers point and industry kinds point.

The workers point is number of workers walks to café near their work place for lunch and exchanging their knowledge. The industry kinds point is number of kinds of workplace in knowledge exchanging. This Knowledge Exchanging Index is based on the following assumptions:

-Workers usually go to *Café* or *Bar* to lunch every day;
-One worker stay in a one Industrial grid;
-Workers go to *Café* or *Bar* within distance of their industrial units;
-Workers exchange their knowledge with other workers from other industrial units or industrial cluster;
-In case there are plural *Café* or *Bar* within walking distance, workers go to each *Café* or *Bar* with distribution which is inversely proportional to the distance.

3. CURRENT SITUATION OF INDUSTRIES IN BOLOGNA AND TOKYO ITABASHI

3.1 Industries in Bologna

Comune di Bologna, which is the target of this research, belongs to the metropolitan area of Bologna and it has the 39% of the inhabitants and the 4.5% of the surface. In 2016 the metropolitan area of Bologna had 84,898 enterprises; 32,459 of them (38.2%) were settled in the municipal territory of Bologna[12]. Most of these companies are very small (the 55% are individual enterprises) and they are mostly *imprese artigianali*.

Italian law (n. 445/1985) defines *impresa artigianale* an enterprise exercised by an *artigiano* (who carries it personally and professionally as a holder) which has the purpose of carrying out a business of producing goods, including semi-finished goods or services, within precise dimensional limits (ie with a limited number of employees: from 9 to 16 depending on the different production categories).

Traditionally in Bologna most companies belong to the mechanical sector, but recent trends show a downturn in the manufacturing industry in favor of the production of services, linked also to the affirmation of Bologna as a tourist city and a capital of the Emilia-Romagna "food valley". In this perspective, there is also an increase in quality handicraft production, linked to local traditions.

From a juridical point of view, most enterprises in Bologna (as in other cities of "the third Italy") are *imprese artigianali*, of limited size, and have their headquarters within urban settlements, close to other activities (residence, trade, etc.). In some cases, the concentration of *artigianale* and *industriale* determines industrial clusters specifically characterized by the prevalence of production compared to commercial and residential function. In Bologna this is particularly evident in the Roveri area, an industrial cluster that extends for about 2 km^2 on the northeastern outskirts of the city.

Roveri area is the subject of a "laboratory" that deals with the sustainable urban regeneration of the district. The activities of this laboratory, conducted by Enea and Unindustria with the City of Bologna and the Emilia-Romagna Region, focus on the transformation and innovation of the area and consider as a good starting point the mixed character of this settlement. In other words, the presence of public spaces and of collective places and facilities, but also of housing within the cluster, is considered as an opportunity from which to start imagining the renewal of businesses - both the physical space they occupy and their production strategies[13]. The hypothesis of regeneration founded on the renewal and the increase of public spaces, meeting points and facilities seems coherent with the statement of this research, that considers *Cafés* and *Bars* as possible knowledge exchanging places in the city.

3.2 Industries in Itabashi Ward of Tokyo [14]

Itabashi Ward of Tokyo is located in northern part of Tokyo metropolis which has population of 561,916, area of 32.22 km^2, one of the leading industrial cities in Tokyo, and established a firm position as one of the heavily industrialized areas of Tokyo. The northern part of Itabashi is wide industrial area that includes some of the few industrial districts in Tokyo in which factories with a high production capacity are operating.

In particular, the optical industry has been occupying a large part of industries of Itabashi. There are many workers and sub conductor's factories with superior skills are in Itabashi. Manufacturing process of the optical industry consists of production, assembly and adjustment of parts including lenses, prisms and bodies. Although the companies in each stage are independent, they worked together, and exchange knowledge for innovation. Itabashi ward of Tokyo has great advantage of several fields in manufacturing process of the optical industry.

3.3 Allocation of *Café* as Knowledge Exchanging Place for Innovative Industries

Fig.4 shows allocation of *café* in walk zone of Industrial Units in Bologna. 461 *Café* are shown with 250m buffer line and 750m buffer line. 19.2% of *aree industriali* are in 250 m zone of *Café*,

68.6% of *aree industriali* are in 750 m zone of *Café*. Although almost of *Café* in Bologna are located in center of the city, some of café are near *aree industriali*.

Fig.5 shows allocation of *Café* in walk zone with a great presence of *artigiani* in Bologna. 68.0% of *artigiani* are in 250m zone of *Café*, 89.0% of *industriale* are in 750 m zone of *Café*. *Artigiani* are very close to *Café* compared with *industriale*. There are a lot of *artigiani* in center of Bologna so that workers of *artigiani* could meet their customers, colleagues of affiliated companies and worker of other *artigiani*. So workers of *artigiani* can walk to *Café* in city center easily every day.

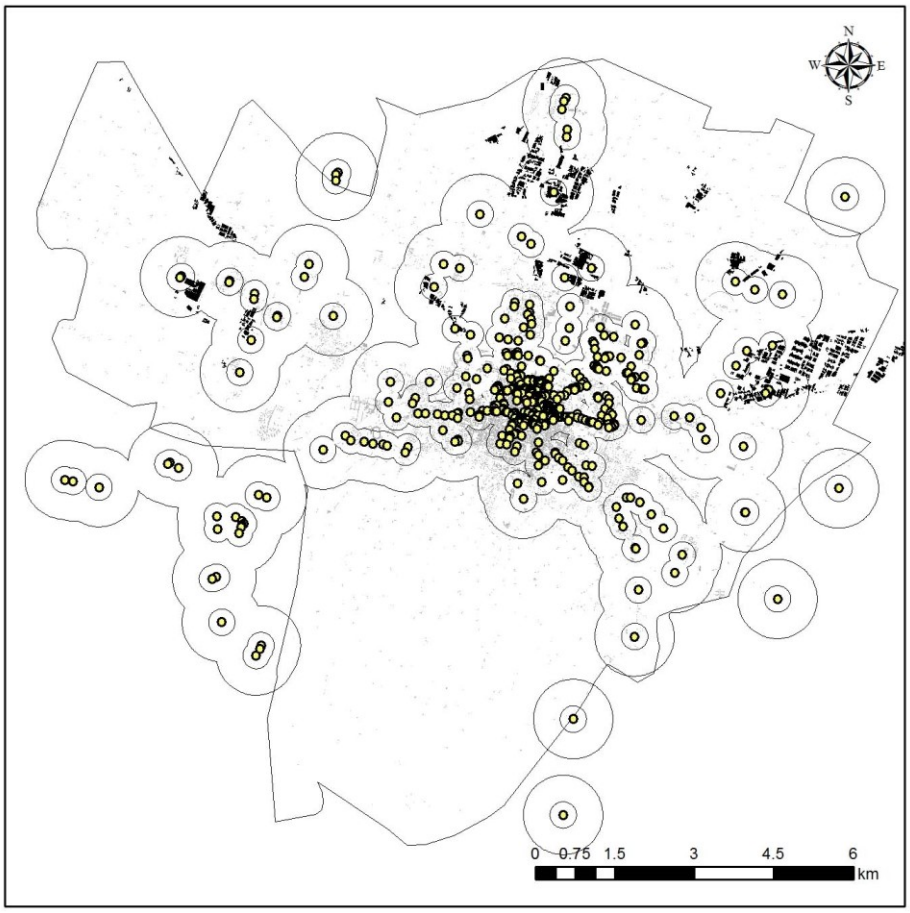

Fig.4 Allocation of *café* in walk zone of *attività industriali* in Bologna. *Cafe* are shown with 250m buffer line and 750m buffer line. Black polygons show the seats of industrial activities.

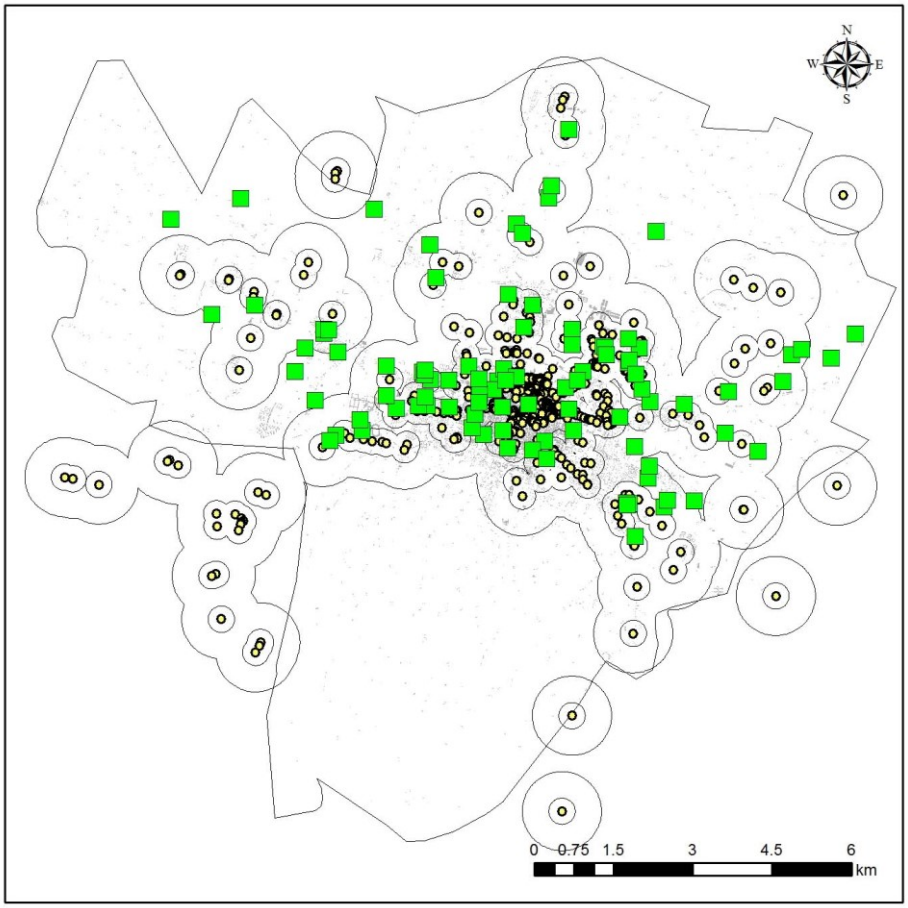

Fig.5 Allocation of *café* in walk zone of *attività artiginale* in Bologna. *Café* are shown with 250m buffer and 750m buffer. Square points shows the seats of *artigiani*.

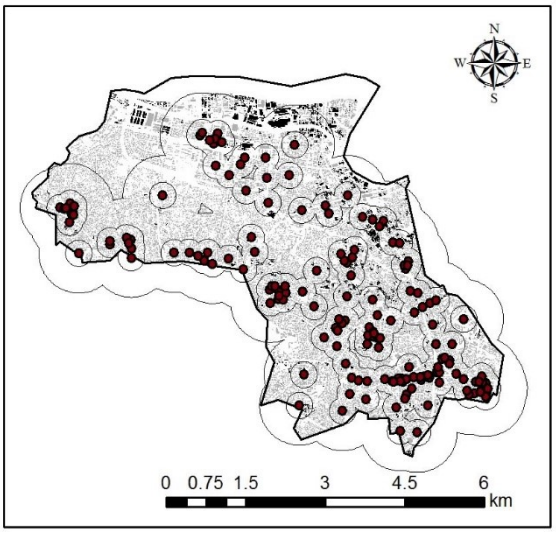

Fig.6 Allocation of *Café* in walk zone of Industrial Units in Itabashi Ward of Tokyo. *Café* are shown with 250m buffer line and 750m buffer line. Black polygons show *industriale.*

Fig.6 shows allocation of *Café* in walk zone of industrial unit in Tokyo Itabashi. 162 *Café* are shown in the Itabashi area. 28.2% of industrial units are in 250m zone of *Café*, 79.6% of industrial units are in 750 m zone of *Café*. There are large type industrial units and small type industrial units like *artigiani* in this area. The small type industrial units are in urban area, and are close to *Café* like *artigiani* in Bologna. On the other hands, there are few *Café* near northern part of Itabashi, and workers in that industries cannot walk to *Café* easily.

Fig.7 shows allocation of *Café* in walk zone of industrial unit in Chiba City which located in east end of Tokyo metropolitan area. 142 *Café* are shown in the area. Only 1.6% of industrial units are in 250m zone of *Café*, 10.2% of industrial units are in 750 m zone of *Café*. Very large type of industrial units are in seaside zone without *Café*. Workers of the industries in this area, especially thus large type of industrial units, cannot walk to *Café* entirely, do not have opportunity of meet other workers from other industrial units.

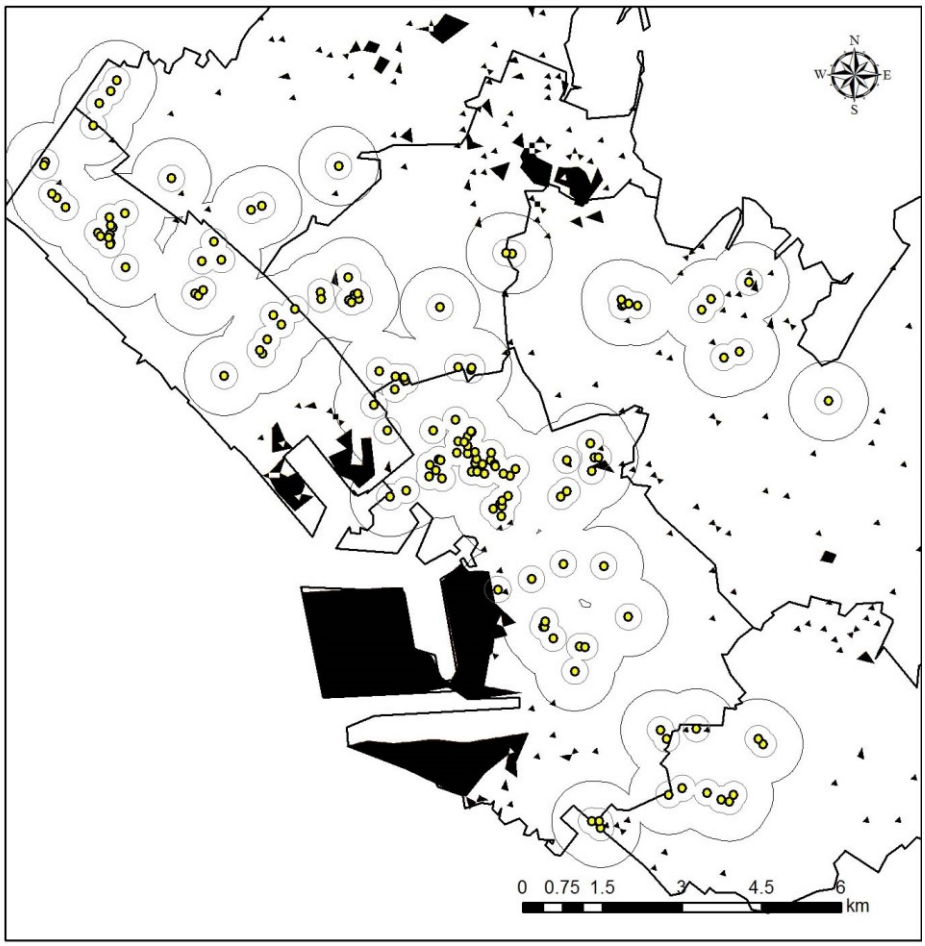

Fig.7 Allocation of *Café* in walk zone of Industrial Units in Chiba *Cafe* are shown with 250m buffer line and 750m buffer line. Black polygons show *industriale.*

Table1 Allocation of *Café* in walk zone of Industrial Units

	within 50m of café	within 250m of café	within500m of café	within750m of café	within1000m of café	within1500m of café	within2000m of café
Bologna_artigiani	10.0%	68.0%	84.0%	89.0%	93.0%	97.0%	99.0%
Bologna_industriale	0.6%	19.2%	52.4%	68.6%	77.6%	90.2%	95.4%
Tokyo_Itabashi	0.7%	28.2%	57.2%	79.6%	91.5%	98.4%	100.0%
Chiba	0.0%	1.6%	4.9%	10.2%	16.2%	24.7%	42.7%

Table1 is percentage of allocation of *Café* in walk zone (50m, 250m, 500m, 750m, 1500m and 2000m) of Industrial Units in Bologna, Tokyo Itabashi and Chiba. *Artigiani* in Bologna allocates the nearest place of each *Café* compared with *Industriale* in Bologna, Itabashi and Chiba. In case that café is the knowledge exchange point, almost of *Artigiani* are advantage to get innovative knowledge. About 70% of *Industriale* and Industrial Units in Itabashi are in 750m zone of *Café*, although there is room for improvement.

It is said that easy accessibility distance is within 250m [15], this research in the following defines walking zone as within 250m.

4.KNOWLEDGE EXCHANGE FOR INNOVATION

4.1 Knowledge Exchanging Index

Fig.8 shows the knowledge exchanging index of 250m walking zone of *Industriale* in area of Bologna. Some of *Cafés* near industrial cluster in east side have high point of the Index. If those Cafés have functions, for example, like co-working place or conference room, they have high potential to bring good influence to innovative industry in this zone. Or, it is considered to allocate industrial units to the zone near *Cafés*.

Fig.9 shows the knowledge exchanging index of 250m walking zone of industrial units in area of Itabashi. High point *Café* in this area are near small type of industrial units in urban area in southern part. Large type industrial units in north part has low index than that of east side in Bologna.

Fig.10 the knowledge exchanging index of 250m walk zone of *Artigiani* in area of Bologna. Many *Cafés* are close to several kinds of *Artigiani*, so have high point of index (in this area). Compare with *Industriale* in Bologna and Itabashi, the Indexes of *Artigiani* are stable, although it is impossible to compare in scalar potential of index because of differences of unit size.

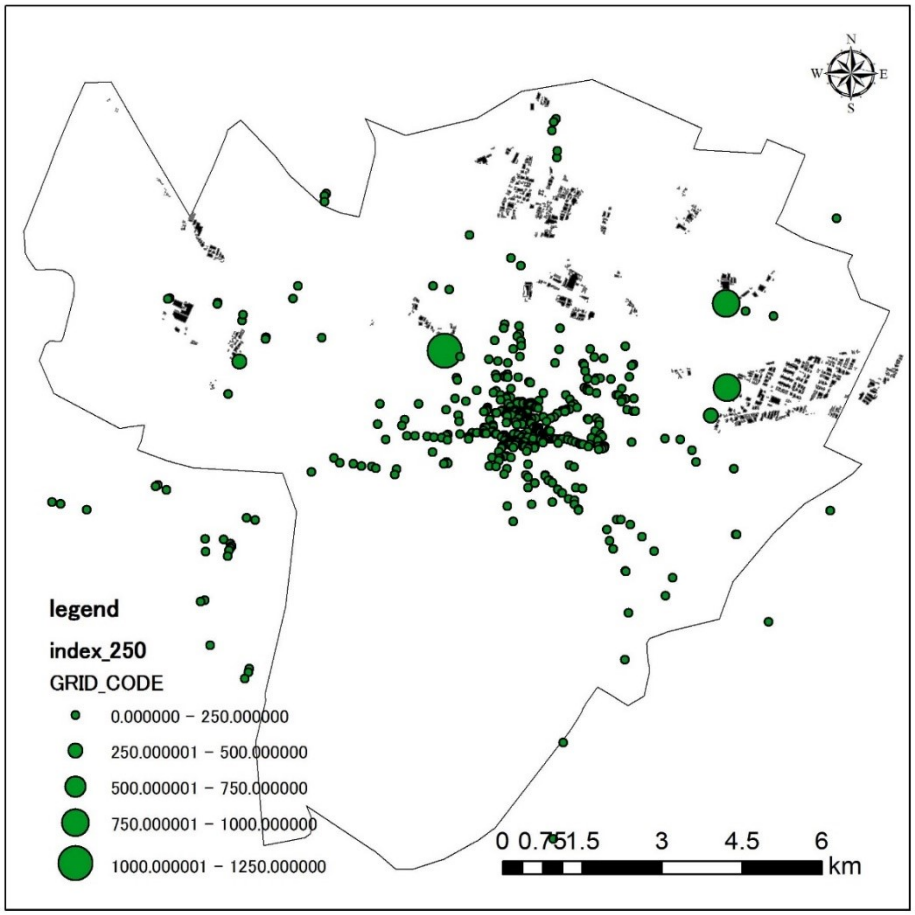

Fig.8 Knowledge Exchanging Index 250m walking zone of *Industriale* in Bologna

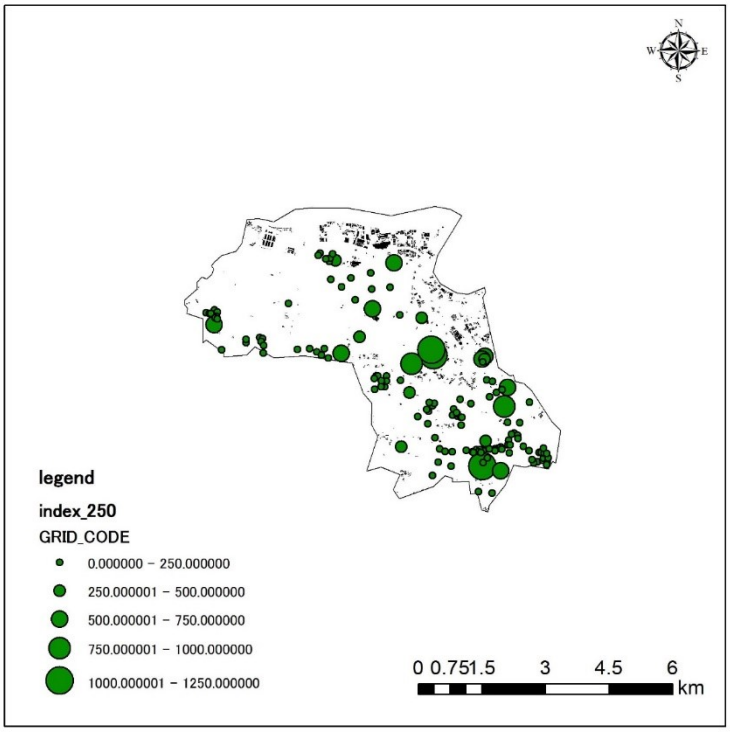

Fig.9 Knowledge Exchanging Index of 250m walking zone in Itabashi Ward of Tokyo

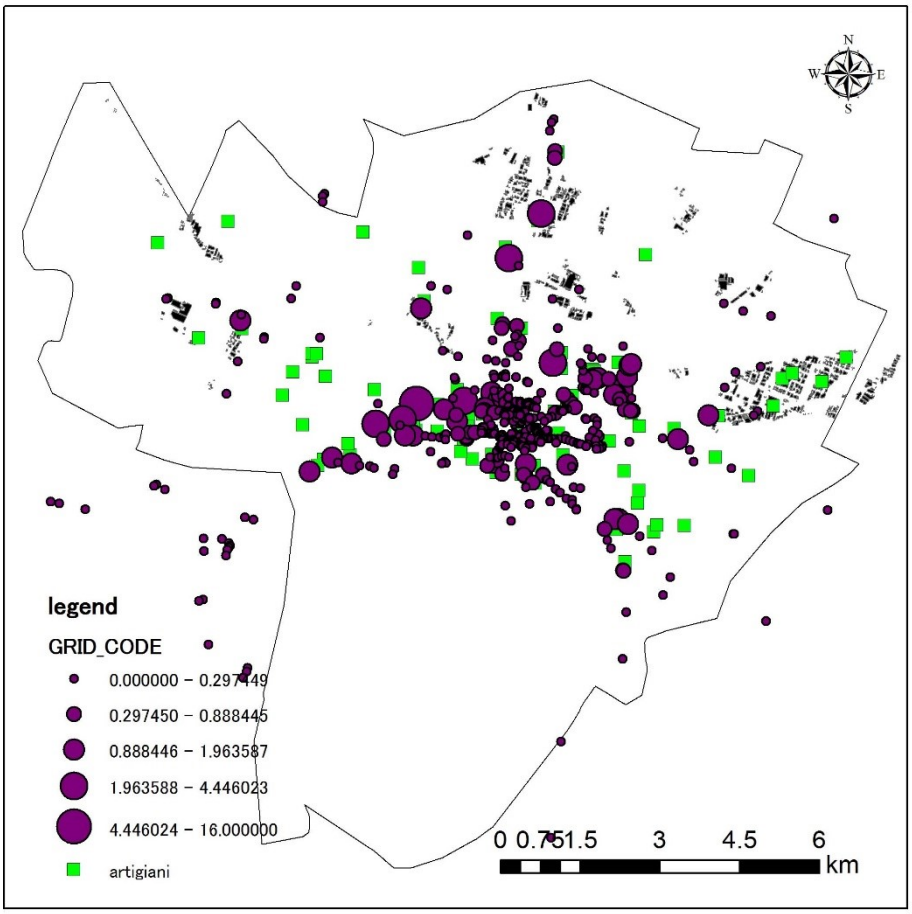

Fig.10 Knowledge Exchanging Index of 250m Walking Zone of *Artigiani* in Bologna shown by variable circles**.** Square Symbols shows *Artigiani*.

4.2 Optimization Simulation of Café based on Knowledge Exchanging Index

Fig.11 shows optimization simulation result of *Café* based on Knowledge Exchanging Index of 250m walking zone of *Industriale* in Bologna. Star symbols shows optimized place which has high point of the index and are non-*Industriale* existing architecture. If the architectures convert to *Cafés* from other facility, a lot of workers within walking zone gather, have potential to exchange knowledge for innovation.

Fig.12 shows dptimization simulation result of *Café* based on Knowledge Exchanging Index of 250m walking zone of Industrial Unit in Tokyo Itabashi. Non-*Industriale* existing architectures with high point of the Index are in north part near river side. There are no *Café* near there.

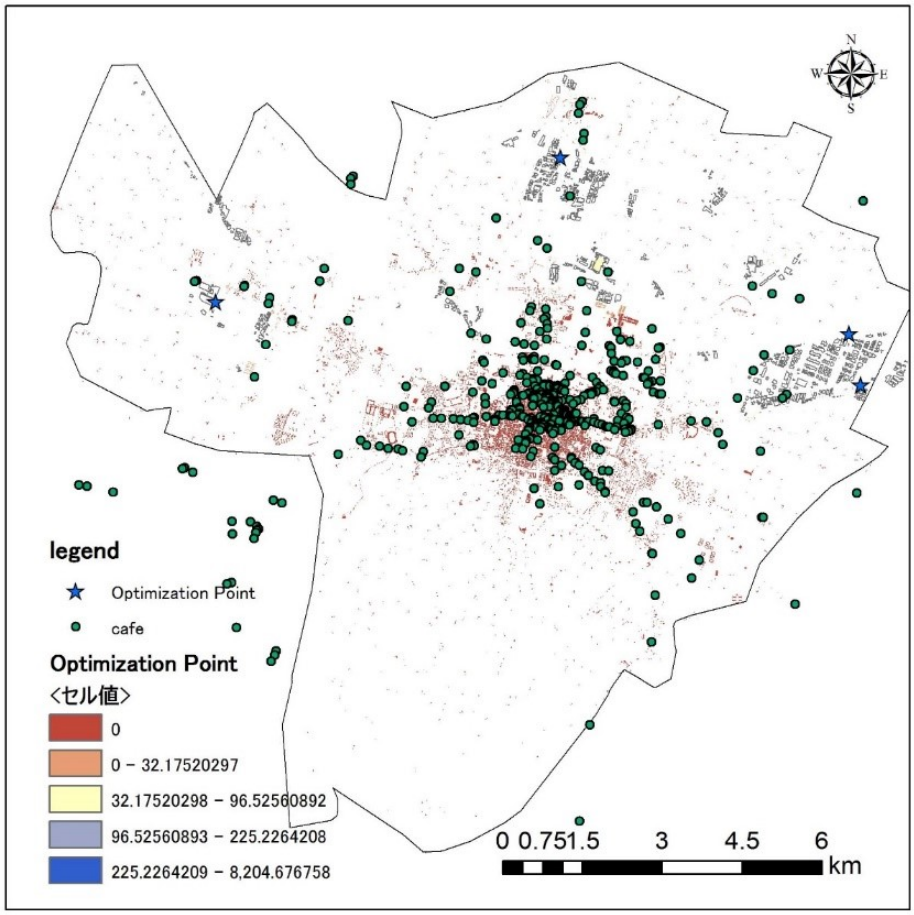

Fig.11 Optimization Simulation result of Café based on Knowledge Exchanging Index of 250m Walking Zone of *Industriale* in Bologna. Star symbols shows optimized place which has high point of the index. Gray polygons are *Industriale*, red to blue polygons are non-*Industriale* existing architecture.

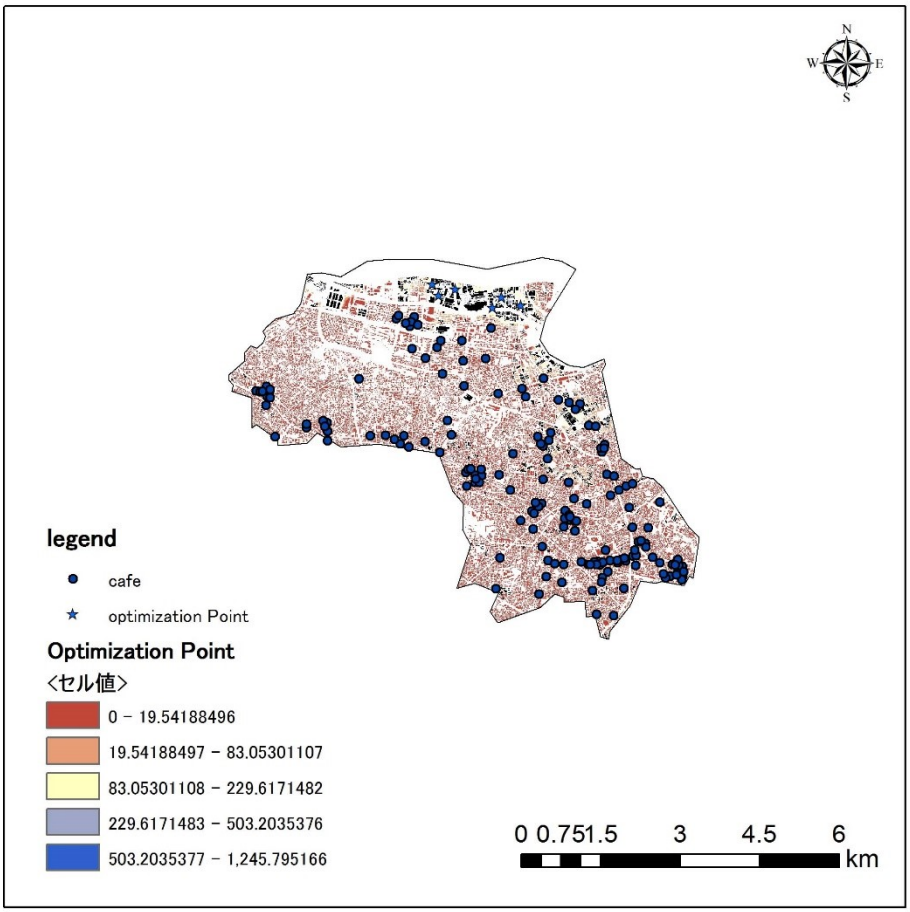

Fig.12 Optimization Simulation result of *Café* based on Knowledge Exchanging Index of 250m Walking Zone of Industrial Unit in Tokyo Itabashi. Star symbols shows optimized place which has high point of the index. Gray polygons are *Industriale*, red to blue polygons are non-*Industriale* existing architecture.

5.CONCLUSION

This research evaluates environments of workers of *Industriale* and *Artigiano*, by allocation analyzing of *Café* as a place of knowledge exchange from the view point of developing new innovative industries of the 21th century.

The environment of *Artigiani* in Bologna is already high quality for innovative industry in case *Cafés* or *Bars* are the place for knowledge exchanging. Giving co-working function to the *Café* or *Bar* with high accessibility leads to revitalize innovative industries more.

Industriale in Bologna and Industrial Unit in Tokyo Itabashi will have better environment for innovative industry by relocate *Café* or Bar to high knowledge exchanging index place in this research.

There are no *Café* in walking zone of Industrial Units in Chiba and north part of Tokyo Itabashi. It is need to build more new *Cafés* near the Industrial Units for innovative industries.

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