

The empirical study on the emergence and diffusion process of design-driven innovation initiated by knowledge creation : from the field study in the industrial cluster of the Sumida Ward, Tokyo

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1. Purpose of the study:

Japanese Small and Medium Enterprises (SMEs) account for 99.7% of the number of companies, 70% of employment, 50% of added value as well as becoming an important economic entity of Japan as a player of innovation. However, SMEs in Japan are subject to severe circumstances due to changes in the global economic environment.

For this purpose, we shall focus on Design-Driven Innovation (DDI) and propose a means to solve the problem by expanding upon it. A previous study (Verganti 2003) had defined the occurrence of DDI as "innovation driven by new meaning (a reason for human use, which can be created by design), not technology (physical characteristics)". The premise was that it would be caused by groups of individual designers as well as designer-customer teams. This study reveals how, in some cases, the occurrence can also be caused by collaborative design when factory owners within an industrial cluster of high spatial clustering maintain a horizontal relationship.

No explanation had yet been given as to the motivation behind the occurrence of DDI in industrial clusters. Due to this lack of explanation, it was not easy to apply DDI as a policy of regional innovation promotion.

For this reason, in this study, we expanded on DDI and focused on how this model commences and becomes effective within an industrial cluster, verifying its effectiveness in innovation occurrence.

2. Review of previous studies

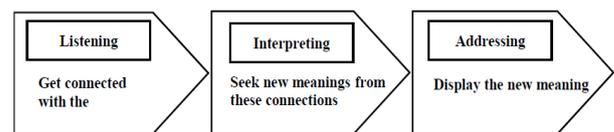
2-1. Definition of DDI and its occurrence process

The concept of DDI was defined by Verganti based on an analysis of about 50 innovation cases. Innovation in products and services are born from both Technology and Meaning, but DDI is a management method market dominance is achieved by radically changing the Meaning that a product has.

DDI is based on the user-oriented MPI, but not only does it propose the What (what people want to use now), it also focuses on the TPI's Why (why people want it in their lives) in order to create an innovation of Meaning.

Let us now explain the occurrence process for DDI. Verganti shows the process from multiple cases that lead to DDI occurrence (see Figure 1).

Figure 1: The process of Design-Driven Innovation



Source: Author, adapted from Design driven innovation: changing the rules of competition by radically innovating what things mean,2003

It is shown within that these characteristics, which is to say that a new meaning has been interpreted not independently by the designer alone but through "connection with the surrounding people", can be confirmed.

2-2. Knowledge-Based Theory of spatial clustering from the Innovative Milieu theory

Malmberg, A., & Maskell, P. (1999) stated that knowledge-based theory of spatial clustering was important for innovation formation. The problem solving process employed by enterprises and regions include elements that are strengthened by the spatial and cultural clustering of participants. The theory is that in case related industries concentrate in a specific space, build an Industrial Milieu and succeed to apply, it is then sustainable.

In this study, based on the preceding research mentioned above, we shall use Sumida Ward, Tokyo as an example. As a region, Sumida Ward has the highest concentration of business

locations in Japan, and its spatial clustering is high. As industries continued to cluster for over 100 years, factory owners began using collaborative design out of fear that they may not survive if they couldn't break away from the subcontracts focused solely on technological superiority which had been imposed on Japanese SMEs.

3. Case study

3-1. Outline of Sumida Ward

3-1-1. From the reconstruction of Tokyo's largest afflicted area to the projected forecast of business losses

Let us first take a look at the regional characteristics of Sumida Ward. Sumida Ward is a region that is representative of the common people's culture from the Edo period (1603-1867), with the development of various traditional crafts being the driving force behind modern light manufacturing industries

And then, in 1923, the Great Kanto Earthquake occurred causing a lot of damage. About 90% of the ward's area was burnt and destroyed, the fires causing 48,000 deaths reaching more than 80% of the total for Tokyo. In addition, World War II turned 70% of the area into ruin, causing 63,000 casualties and nearly 300,000 sufferers all told.

3-1-2. Collaboration between diverse stakeholders and Sumida Ward SMEs

As stated in 3-1-1., as Tokyo's largest affected area, Sumida Ward was pressed for the necessity of creating industries from the ground up. As a result, various stakeholders and SMEs in Sumida Ward cooperated to launch a number of advanced projects.

i.Edokko No.1 Project

The "Edokko No.1" is a compact, unmanned deep sea research vehicle capable of diving to the depth of 8,000m, collect mud and life forms from the sea bed, and use its 3D video cameras to capture 3D imagery. With SMEs from Sumida Ward, Katsushika Ward and Ota Ward at its center, it was developed in 2013 by Shibaura Institute of Technology, Tokyo University of Marine Science and Technology, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Shin-Enoshima Aquarium, volunteers from Sony Corporation, Tokyo Higashi Shinkin Bank, and others.

ii.48-hour commercialization design marathon project.

Within a time-limit of 48 hours, designers, engineers and marketers from large corporations ventured into town with

disabled people, coming up with new findings through repetitive observation and experience, and incorporating these into the production process of "experience, discover, design, verify".

Held by the International Association for Universal Design (IAUD), with the backing and support of the Tokyo Higashi Shinkin Bank, SMEs centered around Sumida Ward were introduced to this approach and SMEs who expressed their will to participate in the project were supported. Participating SMEs can gain from this by learning the product development process and theories of major manufacturers.

iii.Shitamachi canoe

A project to develop competition standard canoes for the 2020 Tokyo Olympics. The production of the canoe is handled by Hamano Products Co., Ltd., a metal processing firm from Sumida Ward. The same company is credited with having lead the structural design of the deep sea research vehicle Edokko No.1 in 2013. In 2016, the Tokyo Higashi Shinkin Bank and Toyo University agreed to an industry-academic collaboration agreement in order to advance joint research between the university and the city's SMEs.

v.Garage Sumida

Opened in 2014 and renewed in 2017, a facility run by Hamano Products Co., Ltd that supports entrepreneurship in manufacturing. Digital machine tools such as 3D printers and laser cutters are available. Also, it is possible to use the office, and one can even use it as a registry office. Events and workshops are held regularly, and, with a freespace where visitors can read or relax at the bar, it is also a place for exchange where anyone with an interest in manufacturing can visit freely.

v.Sumifa

Having first taken place in 2000, Sumifa is an event where visitors get to walk around the manufacturing factories of Sumida Ward, discussing with craftspeople and touching on technology, experiencing the process of how products are manufactured. In 2017, 19 SMEs from Sumida Ward participated. 13 original tours were also organized.

4. Survey method

4-1. Outline of survey

4-1-1. Purpose of survey

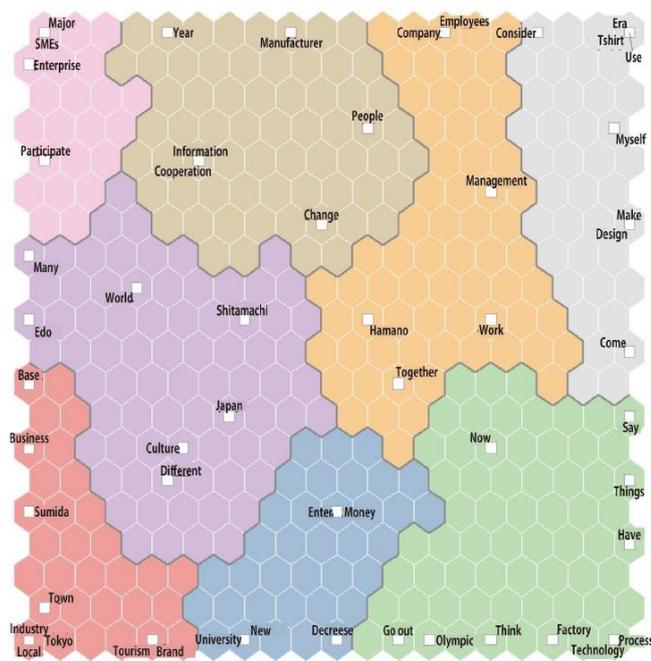
The purpose of this survey is to define the conditions that generate DDI in order to develop regional industries. For this purpose, a semistructured interview survey was conducted with

According to the results from an analysis of the self-organizing map, "Change" and "People" appear in the same hierarchy as "Information" and "Cooperation", and "Design" and "Make" appear in the hierarchy close to "Management".

Through these analyses, it is now possible to imagine a story where design is created and made from the interactions of people within the town's factories.

On the DDI, thought by Sumida Ward as being created by groups of individual designers and designer-customer teams, this research has newly revealed the tendency for it to happen from collaborative design through the horizontal relationship between owners of factories in industrial clusters of high spatial clustering.

Figure5: Self-organizing map



source: Author

6. Considerations

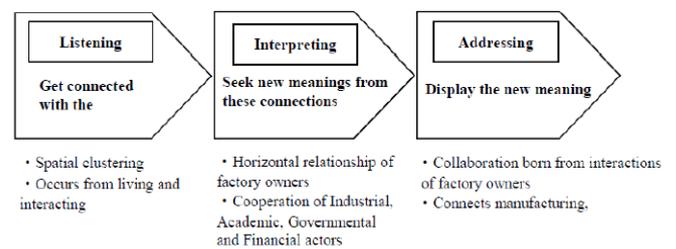
From the above interviews and the results of the analysis, we can consider the following points.

- i. Collaborative design can happen from a horizontal relationship (as opposed to a vertical relationship as shared between a parent company and its subcontractor) between factory owners within an area.
- ii. Collaborative design coming from the horizontal relationship of factory owners occurs from factory owners living and interacting within the extreme geographical and emotional clustering called an "economies of scope".

- iii. The meaning of collaborative design, which is a major incentive for the occurrence of Innovation in Design-Driven Innovation, is neither an individual idea from an individual designer, nor a bilateral idea from a designer and a client, but a cooperative creation coming from exchanges between factory owners.
- iv. To foster this, collaboration between industry, academia, government and financial institution has been developed in the region.

As a result of the considerations from i to iv, the DDI process that occurs in Sumida Ward is represented as in Fig.6.

Figure 6: Structure of DDI occurrence in Sumida Ward



Source: Author, adapted from Design driven innovation: changing the rules of competition by radically innovating what things mean,2003

As described above, it is important to clarify the source of innovation by dissecting the system inherent in the region's DDI, and the forthcoming challenges for this research would be to generalize this and lead on to solutions for an industrial revitalization in other regions.

Notes

- 1) Free software for content analysis (quantitatively text analysis) or text mining. Developed and produced by Kiichi Higuchi (Associate Professor at Ritsumeikan University, Japan) in order to quantitatively analyze various Japanese text data such as answers to open-ended questions in surveys, interview recordings, and newspaper articles.

References

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