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**The Development Process, Scale and Scope of Console
Game Industry in Japan: Through Analysis of a Multiple
Connected Dataset**

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The Development Process, Scale and Scope of Console Game Industry in Japan: Through Analysis of a Multiple Connected Dataset¹

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Abstract

How has the Japanese game industry developed? What impact have the changes in game hardware and the emergence of smartphones had on the game industry? There have been several studies addressing this question (Shintaku et al. 2003, Storz 2008, Uemura et al. 2013, Koyama 2016). Most existing studies, however, have primarily relied on qualitative research methods, based on surveys and interviews of respondents. In contrast, this study tackles the same question with a data science approach. By doing so, we hope to complement the results of previous studies.

We will combine several databases created for different purposes in our approach. One such database is that of Teikoku Databank (Corporate DB), which provides information on the financial and credit standing of companies. The others are the "RCGS Collection," a catalog of the holdings of the Game Research Center of Ritsumeikan University, and the "Media Arts Database," a comprehensive catalog of media arts by the Agency for Cultural Affairs (bibliography DBs), which were created to understand the cultural value of games. Using the bibliography databases to link the entities of organizations involved in publishing and developing products to the aspects of corporate management in the corporate database, we aim to clarify both the reality of the economy that supports culture and the context of culture created from economic intentions. This study focuses on the same market among the game industry since the main target of the bibliographic database is home video game software (Console Game Industry).

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Based on the dataset we developed, we verified existing findings about the size and scope of the industry (Console Game Industry) and discovered new ones. In terms of the number of companies involved in the industry, the 2000s represented the largest number. As for the number of companies entering the industry, we found it increasing continuously until the early 2000s, and then stagnating after 2010 (Figure. 1).. For the average number of employees, we confirmed a gradual decrease until the early 2000s (Figure. 2). Additionally, we found that capital increased rapidly in the 1980s (Figure. 3), and sales decreased after the mid-1990s (Figure. 4).

Our future plans include using transaction data from the corporate database in order to clarify the formation and development of transaction networks. We will also examine the effect of events such as the shift in game hardware generations and the emergence of smart phones.

1. Introduction

How has the Japanese game industry developed? What impact have the changes in game hardware and the emergence of smartphones had on the game industry? What is the scope and scale of the Japanese game industry? In this research project, we aim to answer these questions by combining a database of released games with one of the largest corporate databases in Japan. In this paper, we describe the dataset that we have developed to clarify the scope and scale of the game industry and report the factual findings that have been derived from it. Then we will present the research prospects for the future.

2. Review of existing research

A substantial body of research has clarified the nature and mechanisms of the game industry, including the overall business of handling hardware and software used by games. For example, Shintaku, Tanaka, and Yanagawa (2003) [1] and Storz (2008) [2] Koyama 2016 [3] focus on the structure and changes of the industry as a whole, while Uemura, Hosoi, and Nakamura (2013) [4] focus on the family computer and depict the development of the game industry with a focus on the early days of the industry. On the basis of these studies, we also conducted a preliminary study of the formation process of game industry [5].

However, if we look at the fact that the game industry grew significantly in Japan, we can conclude that innovation led to the establishment of the game industry there. This can then be combined with existing research that has investigated how industries emerge and change when innovation occurs. For example, we can confirm the previous findings and add new findings for the studies on entry and entrepreneurial activity during the establishment of highly uncertain industries (Aldrich & Fiol, 1994 [6]). We can also reexamine the studies on the entry and exit of firms after the establishment of industries, especially on technological change and shakeouts (Klepper & Simons, 2005 [7]).

In the field of game studies, data science approaches have also been taken. The examples of data science approaches studies are an analysis of the historical evolution of adventure games from the viewpoint of DB-based visualization interface (Therrien, Lefebvre & Ray, 2021 [8]) and an analysis of the internationalization of FromSoftware's corporate activities by connecting existing DBs [9].

Research in this paper can be seen as a convergence of the three research areas outlined above. Essentially, it approaches the game industry from a data science perspective and explains the dynamism of the industry before and after its establishment by focusing on the companies. This is significant both as a study of games and as a study of business history and management science. In our research project, data will be used to develop a quantitative answer to the research questions.

3. Outline and Methodology of the Research Project

3.1 Approach to the Research Project

When clarifying the scope and scale of an industry, there are two possible approaches. One is the approach of first identifying the beginning of an industry and then describing subsequent product launches, entry and exit of companies, etc. This approach has been taken in many of the previous industrial studies, such as Abernathy (1978) [10]. However, this a

approach tends to depict the transition of an industry starting from a specific company or product (and service). In the case of the game industry, the development of the industry tends to be depicted with a focus on Space Invaders, the family computer, Nintendo, and Sega. As a result, we tend to underestimate the influences of other companies.

On the contrary, this research project takes the approach of tracing corporate behavior back to the present as the starting point. By this approach, the starting point of the industry will be certified through the research. This will allow us to capture and analyze a broader range of companies that have been involved in the business of games up to the present.

Also, the latter approach is consistent with what we've learned from our oral history interviews. We have conducted 41 interviews with 21 people to collect oral histories since 2016 [11]. Our research confirmed that game industry companies have acquired management resources (people, property, and money) and technologies from existing industries, including the manufacturing industry. In light of this fact, it seems reasonable to define the scope and scale of the game industry by considering the entry and exit of companies and their corresponding activities (transactions, financing, personnel exchanges, etc.) up to the present day.

3.2 Overview and necessity of the database used

In order to reflect the research approach described above in the actual data collection and analysis, this research project first aimed to combine two types of databases.

The first database is a collection of data on the launch of game-related products. We used the RCGS Collection (RCGS data) of the Game Research Center of Ritsumeikan University and the Media Arts Database (Media Arts data) of the Agency for Cultural Affairs for this project. These data allowed us to compile data on 48,118 packages of home video games, arcade games, and PC games from 1972 to 2015. The data can be useful for understanding the companies involved in the game industry, since the game packages include the names of the companies that released and developed the games. This data also includes the platform for using the game and the year of product released. In addition, the year of establishment and location are also recorded for the entity of the launching company. Thus, it is possible to access comprehensively what kinds of products companies released at what time.

Another data source is Teikoku Databank's database on corporations (TDB data), which is available through the Teikoku Databank Center for Advanced Empirical Research on Enterprises and the Economy (TDB-CAREE) at Hitotsubashi University's Graduate School of Economics. The database contains information on corporate profiles, corporate finances, and credit research reports. The database includes unlisted companies and facilitates long-term data panelization of individual companies. Thus, it is possible to track companies' growth and decline based on their finances, as well as findings about capital relations, financing, and business relationships.

In the game industry, there has been a wide range of companies involved. The companies are small and unlisted in some cases. By combining the two types of three databases, we thought we could capture a wide range of participants, improve the coverage rate of companies related to the game industry, and properly capture the size and scope of the industry.

3.3 Procedure for creating Game TDB data

Based on data from RCGS, Media Arts, and TDB, a dataset that integrates detailed company information and launch history was created. To create this data set, the following steps were taken.

First, we extracted the names and outlines of 563 game-related companies from the Media Arts data and RCGS data. We also created a data set that contains not only the names of the companies, but also their postal codes, addresses, and telephone numbers, so that the TDB data could be easily integrated. In total, 851 companies could be listed, and after removing duplicates, a list with information about 746 companies was generated. We provided this list to Teikoku Databank and asked them to match it with the TDB company codes (the first round). Of the 746 companies, Teikoku Databank successfully matched 543 with their respective company codes.

Many companies, however, could not be matched due to incomplete postal codes or addresses. Additionally, some of the 543 companies were duplicates or had merged. Therefore, we checked the addresses and zip codes of the companies that could not be matched. We also reanalyzed the names of merged companies (e.g. Square Enix, Spike Chunsoft), and companies which had changed their names but could still be considered virtually identical. In this process, we used the company information in the industry books (<1> and <2>) on the game industry around 2000. Three members of the group (Hara, Fukuda, and Ikuine) identified duplicate data and companies that matched visually. As a result of this work, we added 96 companies to the list and obtained a list that had been carefully examined. We provided the list to Teikoku Databank again, and asked them to match it with the TDB corporate codes (second round). The total number of software titles released by these listed companies at this point was 9,021.

As a result of the second round of TDB data merging, we succeeded in matching about 340 companies. Among the companies that could not be matched were those with incorrect notation, overseas companies, and those with unknown postal codes or phone numbers. Our four members (Hara, Fukuda, Shigehara, and Ikuine) checked these items visually again. At this stage, we rely on websites to supplement information about much smaller companies (e.g. Wolf Team). During this process, about 600 companies were identified, but the data was easily matched.

Therefore, we provided the list of about 600 companies to Teikoku Databank and asked them to match the TDB company codes (3rd round). Through the third round of matching, a maximum of 396 TDB corporate codes could be matched, excluding duplicates. There is almost complete information associated with this list, such as company name, zip code, address, phone number, year of establishment, and number of titles released. Further, the TDB data enabled corporate credit reports and company profiles to be linked together. We refer to this database as the Game Teikoku Databank Database (Game TDB Data). In the next chapter, we describe the results of our preliminary analysis using the Game TDB data.

4. Results and discussion of the preliminary analysis: Firm behavior before industry formation and performance after industry entry

4.1 Analyzing Industry Dynamics

We start by looking at how many firms there are (Figure 1). From the 1980s to the 1990s, the number of firms increased from around 100 in the early 1980s, when matching was possible. During the 2000s, the rate of increase decreased, but the upward trend remained. In the coming decades, this trend will be reversed. Although data truncation and other factors need to be taken into account, the number of game companies has been on a downward trend since 2017.

Figure 1: Changes in the number of companies

The average number of employees per company (left axis) and the age of the representative (right axis) are shown in Figure 2 below. For comparison, we also show the average number of employees and age of representatives for all industries obtained from COSMOS 2. A decline in the average number of employment has been observed from the 1980s to 2000. After that, it gradually increased in the 2010s. Additionally, the representative's age has stayed around 51 since the 2010s. However, it is interesting to note that the age of the representative has increased since the 2010s, rising from 52 in 2010 to 56 in 2019, as it is a same trend of all industries average.

Figure 2: Changes in the average number of employees and representative age

4.2 Changes in the size of companies

As shown in Figure 3 in left axis, companies in the 1980s have increased their capitalizations. All industries average's also shown in right axis. Although the increase in average capital slowed in the early 1990s, it has continued to rise again ever since.

Figure 3: Changes in average capital (Unit: thousand yen)

On the other hand, the trend in average sales is shown in (Figure 4). During the 1980s, sales were on an upward trend, but after 1991 they were on a downward trend. Though the industry has grown in size and number, the average sales per company have continued to decrease. It is contrast to the upward trend of all industries' average in 2010s.

Figure 4: Changes in average sales (Unit: million yen)

4.3 Composition of the game industry

Games were not categorized in the TDB's industry classification. Therefore, we checked the TDB industry classifications <3> for each decade in the company information database to see what industries the matched firms belonged to. The results are presented below (Tables 1 and 2).

Table 1: TDB industry classification to which the companies belong (1)

Table 2: TDB industry classification to which the company belongs (2)

It can be inferred that most of the game industry, specifically game software vendors, came from other industries. There is also a possibility that such entry from other industries occurred in the 1980s and 1990s, and that existing players accounted for most of them after the 2000s. As revealed by previous studies, this is consistent with the process by which the game industry was created. And in table 4, we have shown firm characteristics, such as sales, capital size, number of employees, and representative age, for each major TDB industry classification. It indicates some trends across the industry, that is, (a.) upward trend of capital stock and representative age, (b.) downward trend of average sales, in contrast to, (c.) downward spiral of the number of employees in 1990s and 2000s and slightly rebound in 2010s.

Table 3: Changes in the company size in major TDB industry classification

5. Tentative conclusions and future research topics

The purpose of this report is to explain the theoretical and practical background of the research project, its objectives, and its basic questions. Additionally, we discussed how to create a data set in order to answer the research questions, and what kind of new findings will be possible by using the created data set.

Based on the Game TDB data, we were able to determine that the number of companies increased from the 1980s through the 1990s when the Family Computer and PlayStation were introduced, but that number has been decreasing since 2010 when smartphones became more common. Further analysis of the TDB data from games will be conducted in the future. We will examine (a) the growth process and entry/exit of each company, (b) the corporate behavior over time from the relation of the comprehensive data on console video game publication by the Media Arts Database, and (c) the formation and growth of transaction network analysis. The purpose of these analyses would be to provide an overview of how the game industry has developed in Japan. Furthermore, it will provide insight into management science and business history, such as how entrepreneurs and management resources are gathered to develop industries.

To this end, qualitative data from oral histories and newspaper and magazine databases will also be useful, in conjunction with quantitative analysis using Game TDB data. This is because the intentions and actions behind figures such as the number of game software releases

ses and corporate performance are expressed in words (discourse), which are recorded in oral history (Yamaguchi and Kim, 2017) [11]. For example, the identity of "we are in the business of games" can be depicted only by using qualitative information. To capture the development process from multiple perspectives, it will be important to combine quantitative and qualitative data. Considering the major question of how an industry emerges, the Japanese game industry appears a good example based on available data.

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Others

<1> Hisakazu Hirabayashi, "Game Industry Employment Handbook" 1998, 1999, 2000 and 2001 editions.

<2> Toho Gakuen, "Game no zenryoku 2000", Shinkijinsha.

<3> TDB Industry Classification Table, <https://www.tdb.co.jp/lineup/pdf/tic.pdf>

Appendix

A. List of Research Materials

Game Research Center, Ritsumeikan University. RCGS Collection (RCGS Data). <https://collection.rcgs.jp/>

Agency for Cultural Affairs. Media Arts Database (Media Arts Data).

<https://mediaarts-db.bunka.go.jp/>

Teikoku Databank. Corporate Data (TDB Data).

<https://www7.econ.hit-u.ac.jp/tdb-caree/>

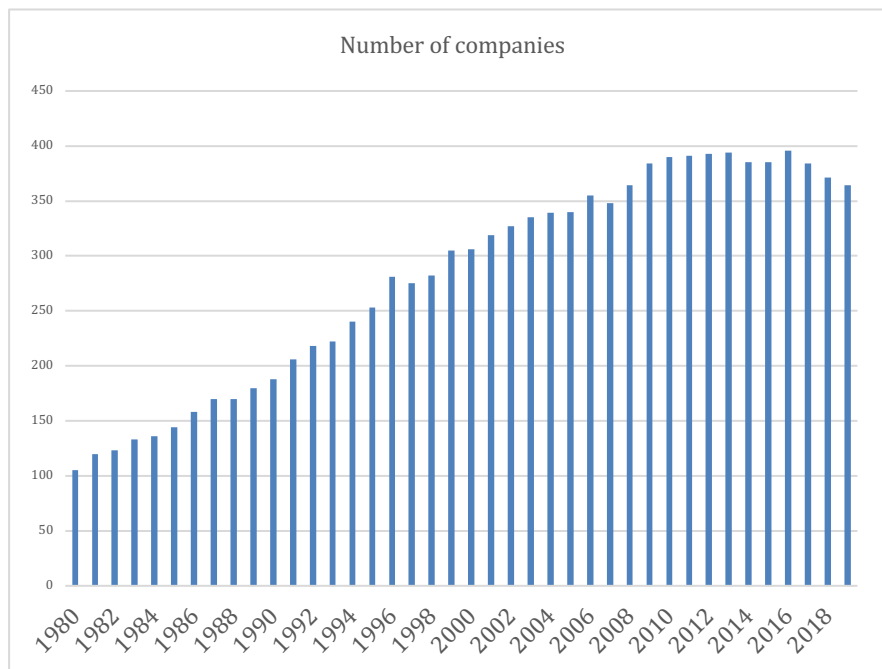


Figure 1: Changes in the number of companies of Game Industry

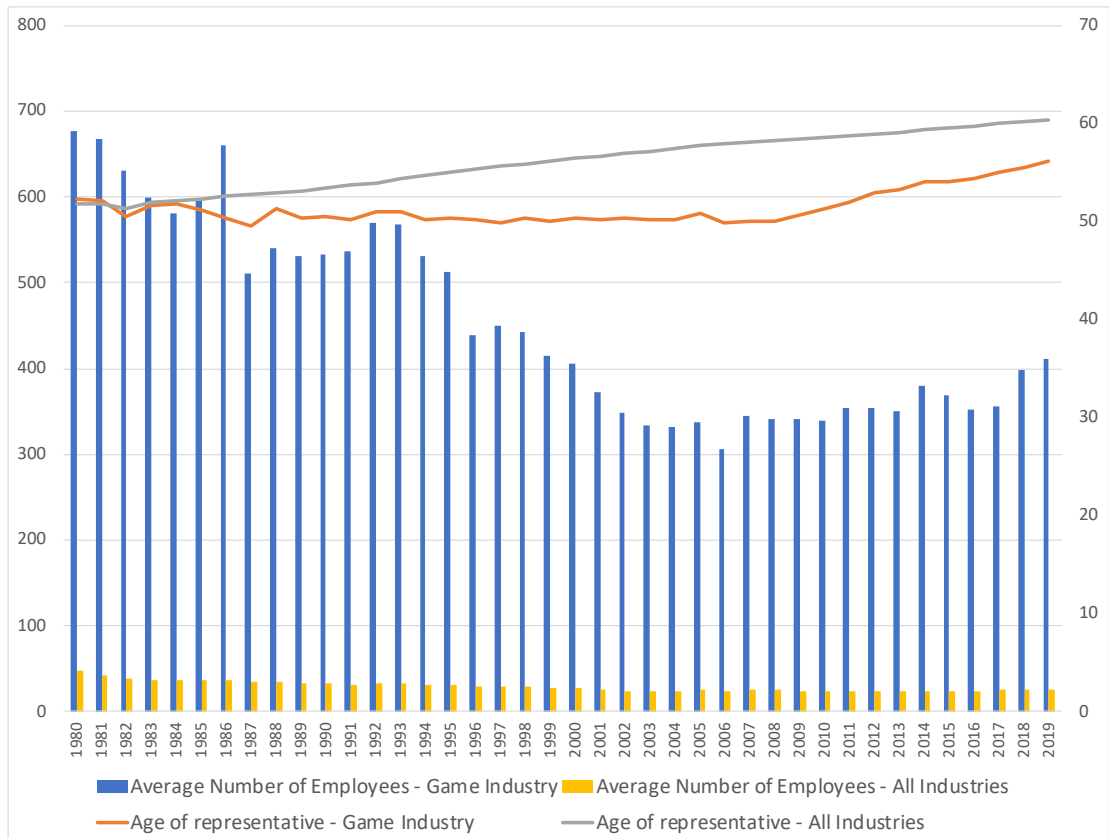


Figure 2: Changes in the average number of employees [Left Axis] and representative age [Right Axis] (Game Industry and All Industries)

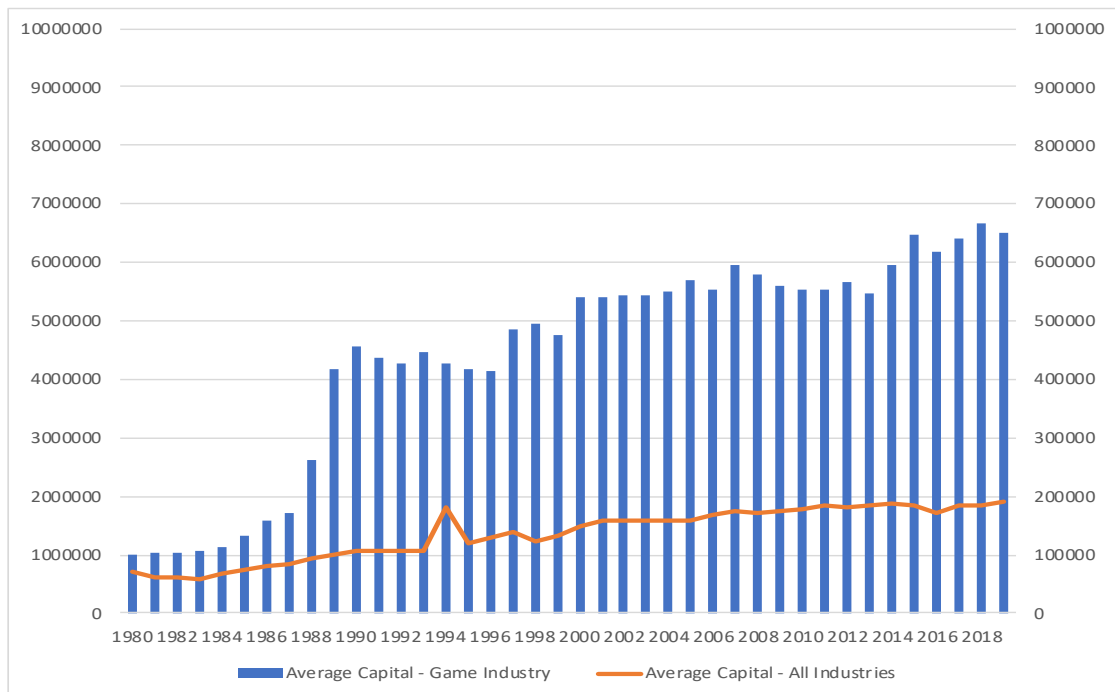


Figure 3: Changes in average capital of Game Industry [Left Axis] and All Industries [Right Axis] (Unit: thousand yen)

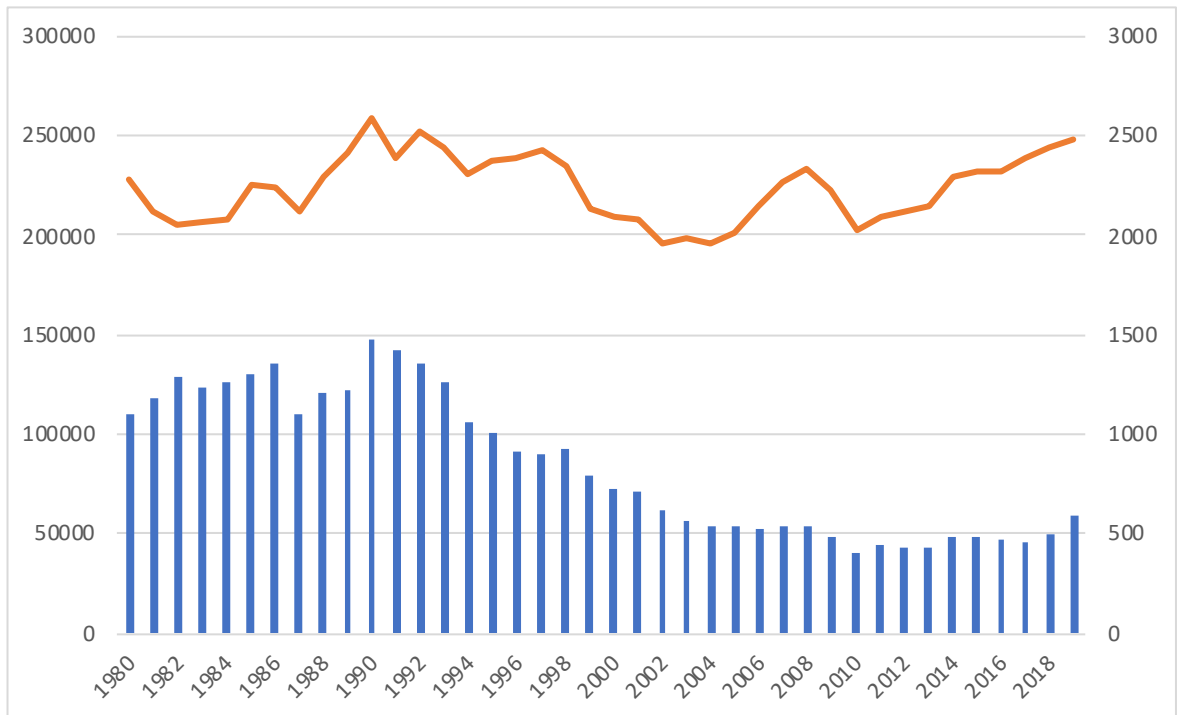


Figure 4: Changes in average sales of Game Industry[Left Axis] and All Industries[Right Axis] (Unit: million yen)

Table 1: The company's classification by TDB (1)

No.	1980	1990	2000
1	Publishing and printing	Advertising and Information Services	Advertising and Information Services
2	Wholesale	Publishing and printing	Publishing and printing
3	Other manufacturing	Wholesale	Wholesale
4	Other	Other manufacturing	General Machinery and Equipment Manufacturing
5		Manufacture of electrical machinery and apparatus	Image and video production
6		General equipment and apparatus manufacturing	Other business services
7		Film and Video Production	Professional services
8		Other	Electrical machinery and equipment manufacturing
9			Other

Table 2: The company's classification by TDB (2)

No.	2010	2019
1	Advertising and Information Services	Advertising and Information Services
2	Publishing and printing	Publishing and printing
3	Wholesale	Wholesale
4	Other Business Services	Other Business Services
5	Film and Video Production	General machinery and equipment manufacturing
6	Other Manufacturing	Film and Video Production
7	Professional services	Other Manufacturing
8	General machinery and equipment manufacturing	Professional services
9	Other	Other

Table3. Changes in the company size in major TDB industry classification
(a). Advertising and Information Services

	Average Sales(unit; million yen)	Average Capital (unit: thousand yen)	Number of Employees	Representative Age
1980	53559	154500	938.5	59
1990	17010.79	601466.2	274.9524	41.88
2000	7966.451	826103.6	137.7557	44.16541
2010	11779.21	1814708	266.4586	48.12195
2019	23661.84	1470299	289.2292	54.76667

(b). Publishing and Printing

	Average Sales(unit; million yen)	Average Capital (unit: thousand yen)	Number of Employees	Representative Age
1980	51182	393898	820.1762	49
1990	46659.43	2951383	875.1429	54.42857
2000	64173.14	6752672	803.4286	56.57143
2010	36030	671231.1	536.4444	54.5
2019	8773.167	111666.7	140.8333	64.2

(c.) WholeSales

	Average Sales (unit; million yen)	Average Capital (unit: thousand yen)	Number of Employees	Representative Age
1980	1189008	5092266	1212.706	49.64706
1990	1969910	1.87E+07	1168.524	51.14286
2000	961072.4	1.98E+07	986.7826	50.59091
2010	313259.6	2.21E+07	802.3846	52.64
2019	570934.7	3.37E+07	925.6471	59.3125