Global Infrastructure Investment, Competition, and the Japanese Companies

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Abstract

This paper discusses four infrastructure industries all of which are expected to grow rapidly in the 21st century: the electric power industry, the water industry, the railroad industry, and the aircraft and space development.

First, this paper describes the general trends of the FDI in the four noted industries. Based on the above examinations, this paper investigates these industrial trends, focusing on specific companies in various countries. To investigate each individual company, this paper makes use of a large number of documents and reports which each company publishes.

The major conclusions are the following:

First, the four industries share common features. Global competition is characterized by competition between private enterprise and government related companies. In this market, the competition is often obstructed by government intervention.

Second, as development of infrastructure industry grows, it brings about a new business organization model. Just as the railroad industry produced the first modern company, the process of building a new generation's infrastructure will produce a contemporary company suitable for a global economy.

Third, Japanese companies examined in this paper are private enterprises, with the exception of the water service business, and Japanese companies are gaining more presence, and are being asked to lead the private enterprise led global competition.

Keywords: Infrastructure, State-led investment, Private sector-led investment, Privatization, International joint development, Major water company

Introduction

In the 21st century, world population increase, urbanization, rapid economic development, and the rise in the standard of living have combined to increase the need for improved and expanded

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原稿受理日　12月７日

infrastructure. For example, information and communication technology (ICT) is some of the most important, wide ranging **infrastructure** developments of the century.

Shimpo (2009, Chapter 5) examines the information and telecommunications industry, the electrical machinery and the semiconductor industry, and describes how leading technological innovations, and hence their originating companies, have impacted the world economy. In addition, the construction of new infrastructure requires updating and improving the quality of the existing infrastructure.

This paper discusses four infrastructure industries: the electric power industry, the water industry, the railroad industry, and the aircraft and space development, all of which are expected to grow rapidly in the 21st century. Infrastructure investment in electric power and in the railroad industry is expected to lead the world economy, much like it often has in interim war periods.

To build improved infrastructures, investment by companies from developed countries is essential. These infrastructure investments generate a new expansion of Foreign Direct Investment (FDI), and are becoming a driving force in the growth of the world economy.

Section I of this paper describes the general trends of the FDI of several companies in the four noted industries. **Section II** examines the industrial trends of electric power (nuclear power generation), water, railroad, and aircraft and space development, focusing on specific companies. **Section III** emphasizes the importance of the **private sector-led investment** in the four industries.

Currently in the world economy, **state-led investment** (by state-owned enterprises, state monopoly enterprises, and sovereign wealth funds) prioritizes profits of a specific country, and global market competition is often obstructed by government intervention. A general example would be the monopoly held on natural resources by state-led investments. The importance of activating private sector-led investment in the infrastructure field cannot be overstated, especially investment by Japanese companies which are full of growth potential.

Most government offices of the Japanese Government, the representative Japanese journalism argue that public-private partnership (Kan-Min Ittai) is important for the overseas advance of the infrastructure industries. Many Japanese companies in the infrastructure industries also claim that the support and security by their government is indispensable for the high-risk foreign direct investment. The examples in Korea and France are often invoked to support such a request.

However, such a discussion will retreat the global market competition, and strengthen the national confrontation. As I will discuss in the following section, this paper will examine the

significance of the private sector-led investment.

Ⅰ. Recent Global Trends in Foreign Direct Investment

The significance of FDI to the world economy is growing, especially regarding economic development in investing and in the host country. In the latter part of the 20th century, FDI became a major factor in the economic development of emerging countries. Today growth is in part due to the excellent management skills of investment companies, skills which positively benefit the host country.

As shown in **Table 1**, there was a 10% increase in FDI over a 20 year period. In 2009, FDI rose to 19 trillion dollars, from only 2 trillion dollars in 1990. One of the biggest points of interest has been the increase of FDI by developing countries, which was 2,700 billion dollars in 2009. Including Hong Kong, Chinese FDI is approximately 1,100 billion dollars, a relatively large amount.[1] It is important to note that the FDI dollar amount for Hong Kong is not all Chinese investments. The total includes investments from companies in developed companies located in Hong Kong.

Importantly, most investment by developing countries, especially newly emerging countries, is investment by state-owned enterprises, **state monopoly enterprises**[2], or the **sovereign wealth fund**[3]. The role of these state-led investments is significant in terms of the effect on competition in the world economy. This investment often distorts the free global economic competition, and can inspire conflict between states.

The rapid growth of newly emerging countries and the rise of nationalism are also simultaneously actualizing the problems of a host country of newly emerging countries. From the beginning, the demand for management resource transfer that developed country companies have is strong in the host countries. The confrontation between the developed country company and the host country has also happened with the transfer contents in the infrastructure section. An increase of tense political relationships between some newly emerging countries, which are left behind in democratic development, and developed countries appears as pressure towards the developed

1）FDI by developing countries, including China, will be covered in detail later.
2）Refer to Shimpo (2009, 187) for details on state monopoly enterprises.
3）Refer to Shimpo (2009, 201) for details on sovereign wealth funds.

country company.

After World War II, FDI resumed and was considered by many developing countries as a driving force behind the dominance of developed countries in the 1970s oil crisis. To attain economic independence, developing countries nationalized their resource industry companies.

After a while, developing countries began accepting FDI as a driving force for export oriented industrialization. In contrast, corruption and stagnation spread in the companies of nationalized

Table 1. FDI stock, by region and economy, 1990, 2000, 2009 (Millions of dollars)

	FDI outward stock (a)			FDI inward stock (b)			(a)/(b)
Region/economy	1990	2000	2009	1990	2000	2009	
World	**2,086.8**	**7,967.5**	**18,982.1**	**2,081.8**	**7,442.5**	**17,743.4**	
		14.3%	**10.1%**				
Developed economies	**1,941.6**	**7,083.5**	**16,010.8**	**1,557.2**	**5,653.2**	**12,352.5**	
Europe	887.5	3,759.7	9,983.1	808.9	2,440.3	8,037.8	
European Union	**810.5**	**3,492.9**	**9,006.6**	**761.9**	**2,322.1**	**7,447.9**	
		15.7%	**11.1%**				
France	112.4	925.9	1,719.7	97.8	391.0	1,133.0	1.52
Germany	151.6	541.9	1,378.5	111.2	271.6	701.6	1.96
United Kingdom	229.3	897.8	1,651.7	203.9	438.6	1,125.1	1.47
North America	816.6	2,931.7	4,869.7	652.4	2,996.0	3,645.5	
United States	**731.8**	**2,694.0**	**4,302.9**	**539.6**	**2,783.2**	**3,120.6**	**1.38**
		13.9%	**5.3%**				
Other developed countries	237.6	392.1	1,158.0	95.9	216.9	669.2	
Japan	**201.4**	**278.4**	**740.9**	**9.9**	**50.3**	**200.1**	**3.70**
		3.3%	**11.5%**				
Developing economies	**145.2**	**862.6**	**2,691.5**	**524.5**	**1,728.5**	**4,893.5**	
		19.5%	**13.5%**		**12.7%**	**12.3%**	
Latin America and the Caribbean	57.6	204.4	643.3	111.4	502.1	1,472.7	
Asia and Oceania	67.7	614.1	1,946.0	352.5	1,072.2	2,906.0	
Asia	67.4	613.5	1,945.2	349.6	1,067.7	2,893.8	
East Asia	49.0	509.6	1,361.5	240.6	710.5	1,561.5	
China	**4.5**	**27.8**	**229.6**	**20.7**	**193.3**	**473.1**	**0.49**
Hong Kong, China	**11.9**	**388.4**	**834.1**	**201.7**	**455.5**	**912.2**	**0.91**
		62.3%	**105.3%**		**82.8%**	**113.8%**	
Korea, Republic of	2.3	26.8	115.6	5.2	38.1	110.8	
Taiwan Province of China	30.4	66.7	181.0	9.7	19.5	48.3	
South Asia	0.4	2.9	82.0	6.8	29.8	217.7	
South-East Asia	9.5	84.5	342.4	64.3	267.0	690.0	

Source: UNCTAD (2010).

developing countries.[4)]

The 21st century, with rapid growth of newly emerging countries and the rise of nationalism, began a complex period for FDI, and the potential for stagnation developed. Dispersion of investment risk, such as through regional dispersion of investment and the teaming up of several developed country companies, has become an important approach.

The companies leading investment in the four industries secure financing primarily through the world financial and securities market. **Market-centered corporate governance** is increasingly more dominant.[5)] This condition makes the entry and growth of new companies into the market easier, and it opens more possibility of economic development. Under such conditions, it is appropriate to estimate the ability of a company by its stock market capitalization.

Global 500 (FT500) data is used here to investigate and evaluate world enterprises. The downside to this method is that many companies, not just conglomerates, have various businesses. Since FT 500 classifies each company into only one industry, it is quite difficult to draw firm conclusions on how the industrial structure is changing.

Based on FT 500 data, **Table 2** shows the four industries which are the focus of this paper. The aircraft and space development is simply and clearly classified in FT 500. In contrast, the water industry is included with the gas, water, and compound public utility industry. The railroad industry category includes the railroad vehicle maker and the railroad company itself. Only the plant maker is included in the electric power (nuclear energy) category. Japanese companies not reported in FT 500 are reported in Japan 500. Section II will examine this more closely.

It should also be noted that FT 500 includes only public companies. Important global railroad companies such as the French Société Nationale des Chemins de fer français (SNCF) and German Deutsche Bundesbahn (DB), among others, are not reported in Table 2.

Ⅱ. Four Infrastructure Industries and Primary Japanese Companies

The purpose of Section II is to examine the trend of individual companies in the following

4）Refer to Shimpo (2009, 166-169), for the history of FDI.

5）Regarding market-centered corporate governance, refer to Shimpo (2009, 42). Regarding the contrast with other corporate governance, refer to Shimpo (2001, 41, Table 1-13). Regarding the convergence of corporate governance refer to Shimpo (2009, 64).

Table 2. World Representative Companies in Four Industries

	Sector		Global rank 2010	Company	Country	Market value	Turnover	Net Income	Total Assets	Employees
						$m	$m	$m	$m	
Electric Power (Nuclear Power Generation)										
Global	General industrials	**1**	**9**	**General Electric**	**US**	**194,246**	**155,777**	**11,025**	**781,818**	**304,000**
Global	General industrials	6	360	Toshiba	Japan	21,905	68,342	-3,528	52,380	199,456
Global	Electronic & electrical equipment	6	480	Hitachi	Japan	16,875	102,704	**-8,086**	94,673	361,796
Japan	Industrial engineering	4	49	Mitsubishi Heavy Industries		13,973	34,668	249	46,388	67,416
	Total					**246,999**	**361,491**	**-341**	**975,259**	**932,668**
Water										
Global	Gas, water & multiutilities									
Global		**1**	**59**	**GDF Suez**	**France**	**87,500**	**114,481**	**6,415**	**243,561**	**242,714**
Global		2	73	E On	Germany	74,014	**117,216**	12,029	214,269	88,227
Global		3	135	RWE	Germany	49,674	66,176	5,116	131,177	70,726
Global		4	326	National Grid	UK	24,065	22,225	1,343	63,059	27,886
Global		5	342	Centrica	UK	22,883	35,482	1,364	30,546	32,823
Global		6	368	Duke Energy	US	21,388	12,719	1,075	57,040	18,680
Global		7	436	Snam Rete Gas	Italy	18,131	3,493	1,049	27,160	6,187
Global		8	472	Veolia Environnement	France	17,152	48,935	837	69,048	291,000
Global		9	476	Gas Natural SDG	Spain	17,050	21,317	1,712	63,626	18,314
Global		10	492	Hong Kong and China Gas	Hong Kong	16,280	1,593	667	8,526	
	Total					**348,138**	**443,636**	**31,605**	**908,011**	**796,557**
High Speed Rail										
Global	**General industrials**	**2**	**54**	**Siemens**	**Germany**	**91,728**	**112,227**	**3,356**	**134,166**	**405,000**
Global	Industrial engineering	11	431	Alstom	France	18,349	24,657	1,459	30,568	71,511

Global	Electronic & electrical equipment	6	480	Hitachi	Japan	16,875	102,704	-8,086	94,673	361,796
Japan	Industrial engineering	10	168	Kawasaki Heavy Industry		4,610	13,747	120	13,936	32,266
Global	Travel & leisure	3	272	East Japan Railway	Japan	27,825	27,698	1,924	68,902	72,550
Global		8	490	Central Japan Railway	Japan	16,383	16,127	1,295	51,764	26,959
	Total					**175,770**	**297,160**	**68**	**394,009**	**970,082**
Aircraft and Space Development										
Global	Aerospace & defence									
Global		**1**	**78**	**United Technologies**	**US**	**68,929**	**52,425**	**3,829**	**53,660**	**206,700**
Global		2	116	Boeing	US	55,013	**68,281**	1,312	58,991	157,100
Global		3	238	Lockheed Martin	US	31,105	45,189	3,024	31,332	140,000
Global		4	253	General Dynamics	US	29,683	31,981	2,394	30,914	91,700
Global		5	367	Raytheon	US	21,653	24,888	1,935	23,171	75,000
Global		6	396	Northrop Grumman	US	19,853	33,755	1,686	29,242	120,700
Global		7	398	Bae Systems	UK	19,785	32,914	-108	38,595	98,000
Global		8	442	Precision Castparts	US	17,952	6,828	1,045	6,721	20,300
Global		9	484	Rolls-Royce Group	UK	16,749	16,824	3,588	24,333	38,500
Global		10	489	EADS	France	16,449	61,349	-1,093	111,243	119,506
Japan	Industrial engineering	4	49	Mitsubishi Heavy Industries		13,973	34,668	249	46,388	67,416
Japan		10	168	Kawasaki Heavy Industry		4,610	13,747	120	13,936	32,266
Japan	General industrials	4	257	IHI		2,685	14,255	-76	14,785	24,348
	Total					**318,438**	**437,105**	**17,904**	**483,311**	**1,191,536**

Source: FT 500 2010 (2010).

four representative industries in detail. This Section investigates a large number of documents and reports which each company publishes. Because each company emphasizes the information disclosure, we can get them easily through its website.

The study to examine the actual conditions of each country company gets behind except an American company. Therefore, in this paper, we pay attention to companies in various countries as many as possible.

The field where we take notice is the basic financial conditions, the company activities by industry and by region based on their segment information, corporate governance, and the historical development process. Due to the wide-ranging examinations, this paper will clarify the company basic facts and compare each other descriptively.

2.1. Electric Power and Nuclear Power Generation: Three Major Groups

The economic development is the expansion of energy consumption. Energy consumption increases significantly during economic growth of newly emerging countries, and is also higher when energy efficiency is low.

As seen in **Table 3**, the primary energy demand will rise approximately 3% from 2007 to 2030 in Asia and the Middle East. Oil was the most demanded fuel in 2007, but coal demand is steadily increasing and has been catching up. The exhaustion of petroleum resources and the worsening of mining conditions are expected to generate the rise of oil prices.

In contrast, because nuclear energy does not discharge the carbon dioxide believed to impact global warming, its popularity has risen steadily. Having no major accidents since Three Mile Island or Chernobyl, nuclear power is thought to be more reliable now.

Table 4 summarizes nuclear power generation in 38 countries. The United States occupies first place at 105 million kW, and France and Japan follow just below. These top three countries exceed 50% of total output for all 38 countries.

Although not apparent in Table 4, it is interesting to note that France has the highest ratio of nuclear power generation when compared with all other electricity production (76.9%).[6)] The higher ratios in Western Europe belong to Belgium (54.1%) and Sweden (46.1%) The ratio for the United States is 19.4% and for Japan is 27.5%. Sweden and other countries have denuclearization

6）The International Affairs Department, Japan Atomic Industrial Forum, Inc. (JAIF) (March 8, 2009).

policies, but cannot find a good alternative power supply. As a result, they are considering revising their denuclearization policy.

China has the largest nuclear power plant under construction (29 million-kW). When

Table 3.1. World primary energy demand by fuel in the Reference Scenario (Mtoe)

	1980	2000	2007	2015	2030	2007-2030*
Coal	1,792	2,292	3,184	3,828	4,887	1.9%
Oil	3,107	3,655	4,093	4,234	5,009	0.9%
Gas	1,234	2,085	2,512	2,801	3,561	1.5%
Nuclear	186	676	709	810	956	1.3%
Hydro	148	225	265	317	402	1.8%
Biomass and waste**	749	1,031	1,176	1,338	1,604	1.4%
Other renewables	12	55	74	160	370	7.3%
Total	7,228	10,018	12,013	13,488	16,790	1.5%

*Compound average annual growth rate.
**Includes traditional and modern uses.

Table 3.2. Primary energy demand by region in the Reference Scenario (Mtoe)

	1980	2000	2007	2015	2030	2007-2030*
OECD	4,050	5,249	5,496	5,458	5,811	0.2%
North America	2,092	2,682	2,793	2,778	2,974	0.3%
United States	*1,802*	*2,280*	*2,337*	*2,291*	*2,396*	*0.1%*
Europe	1,493	1,735	1,826	1,788	1,894	0.2%
Pacific	464	832	877	892	943	0.3%
Japan	*345*	*518*	*514*	*489*	*488*	*-0.2%*
Non-OECD	3,003	4,507	6,187	7,679	10,529	2.3%
E.Europe/Eurasia	1,242	1,008	1,114	1,161	1,354	0.9%
Russia	*n.a.*	*611*	*665*	*700*	*812*	*0.9%*
Asia	1,068	2,164	3,346	4,468	6,456	2.9%
China	*603*	*1,105*	*1,970*	*2,783*	*3,827*	*2.9%*
India	*207*	*457*	*595*	*764*	*1,287*	*3.4%*
ASEAN	*149*	*389*	*513*	*612*	*903*	*2.5%*
Middle East	128	378	546	702	1,030	2.8%
Africa	274	499	630	716	873	1.4%
Latin America	292	457	551	633	816	1.7%
World**	7,228	10,018	12,013	13,488	16,790	1.5%
European Union	n.a.	1,684	1,757	1,711	1,781	0.1%

*Compound average annual growth rate.
**World includes international marine and aviation bunkers (not included in regional totals).
Source: International Energy Agency (2009).

Table 4. Generating Capacity of Nuclear Power Plants in the World

As of January 1, 2010 (10MWe, Gross Output)

		In Operation		Under Construction		Planned		Total	
		Output	Units	Output	Units	Output	Units	Output	Units
1	U.S.A.	10,534.4	104	120.0	1	940.0	8	11,594.4	113
2	France	6,602.0	59	163.0	1			6,765.0	60
3	Japan*1	4,884.7	54	303.6	3	1,655.2	12	6,843.5	69
4	Russia	2,319.4	27	838.0	10	802.0	7	3,959.4	44
5	Germany	2,150.7	17					2,150.7	17
6	Korea	1,771.6	20	680.0	6	280.0	2	2,731.6	28
7	Ukraine	1,381.8	15	200.0	2			1,581.8	17
8	Canada	1,328.4	18					1,328.4	18
9	United Kingdom	1,195.2	19					1,195.2	19
10	Sweden	938.4	10					938.4	10
11	China	911.8	11	2,944.4	26	902.2	10	4,758.4	47
12	Spain	772.7	8					772.7	8
13	Belgium	620.1	7					620.1	7
14	Taiwan	514.4	6	270.0	2			784.4	8
15	India	412.0	17	316.0	6	680.0	8	1,408.0	31
	Total	**38,915.6**	**432**	**6,513.8**	**66**	**7,460.5**	**74**	**52.889.9**	**572**
	(previous year)	**(39,044.1)**	**(432)**	**(4,775.1)**	**(52)**	**(6,536.7)**	**(66)**	**(50,366.2)**	**(550)**

Note 1: Japanese figures dated 2010.3.31.
Source: Japan Atomic Industrial Forum, Inc. (JAIF), The International Affairs Department (March 8, 2009).

completed, China plans to construct 9 million kW plant. At that point China will become the only country with four nuclear power plants. Japan is planning 17 million kW plant. When complete, Japan will overtake France to become the second in nuclear power production or second in number of power plants.

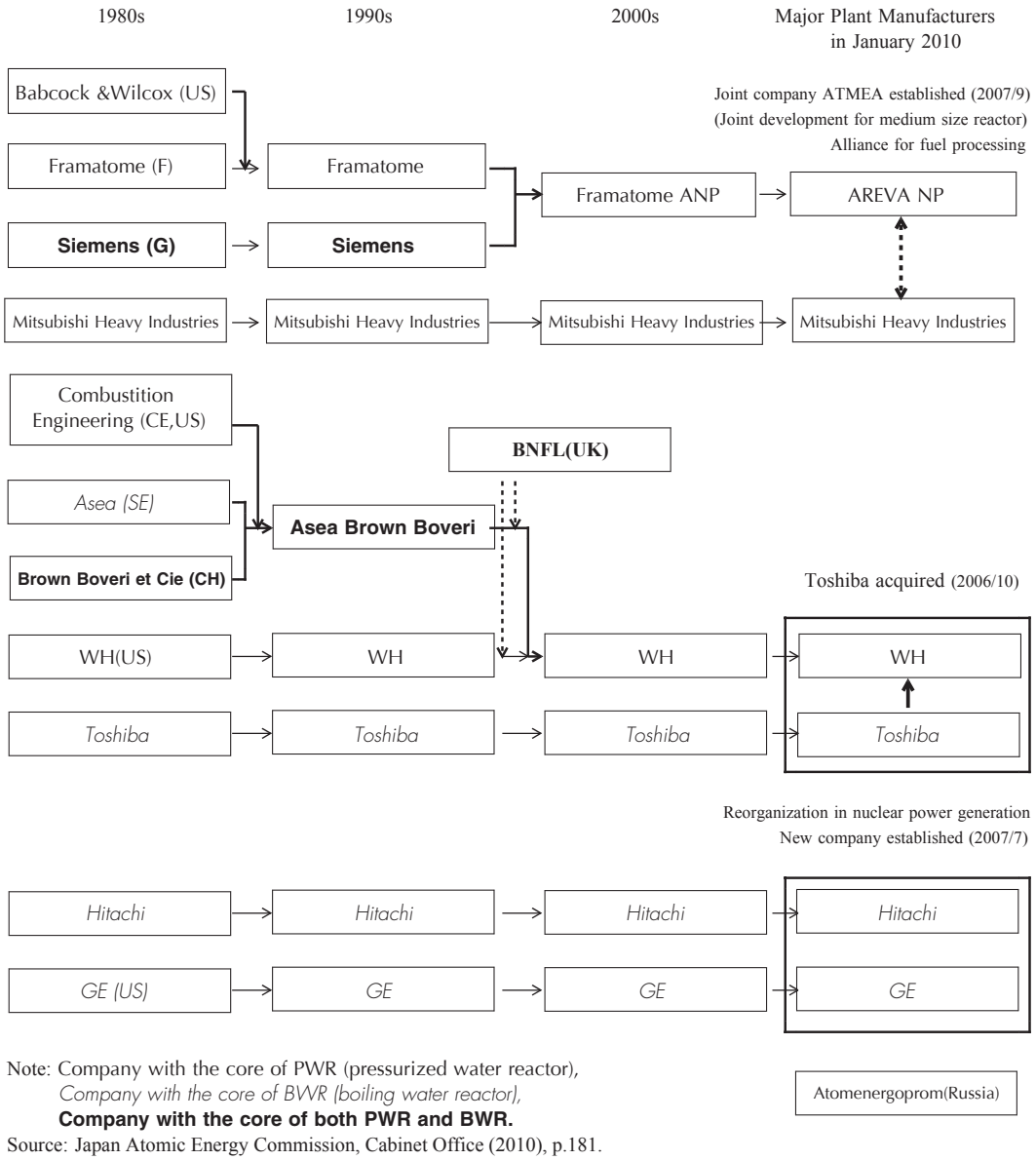
The Nuclear power plant industry involves many technology fields and investment in the industry is risky. As a result, the industry is one of the most often reorganized industries. **Figure 1** shows reorganization from the 1980s to recent years.

The world nuclear plant makers are organized mainly into three groups. In the 1980s, 11 companies built nuclear plants. They were reorganized and integrated into six companies which were then grouped into three. AREVA NP, the first main group, is a combination of the French Framatome and the German Siemens. AREVA NP and Japanese Mitsubishi Heavy Industries

established a joint corporation (ATMEA) in September 2007. They are also working together for developments in the medium size reactor and fuel processing.

AREVA is a typical European company in the sense that the government owns most of its stock. The French government owns either directly or indirectly over 90% of AREVA stock.

The second group, Toshiba, purchased WH in October 2006. WH is a U.S. electrical machinery



Note: Company with the core of PWR (pressurized water reactor),
Company with the core of BWR (boiling water reactor),
Company with the core of both PWR and BWR.
Source: Japan Atomic Energy Commission, Cabinet Office (2010), p.181.

Figure1. Change to Three Groups in Nuclear Power Plant Manufacturers

company, which expanded into nuclear power, by purchasing Asea Brown Boveri and others. Toshiba[7] is involved in various businesses from heavy electric to household appliances. It advances **business selection and concentration** and has been building nuclear power plants and semiconductors, as the pillars of its enterprise. Toshiba's social infrastructure division, including nuclear energy, ranks second only to its digital products division.

The third group includes the world's largest conglomerate GE and Hitachi. Table 2 shows that GE is ranked ninth in stock market capitalization and has 300,000 employees. Hitachi, like Toshiba, is also engaged in the electrical machinery industry. However, Hitachi has developed a large financial deficit of 8 billion dollars (See Table 2). Hitachi is often viewed as being behind Toshiba in business selection and concentration.

The Russian company, Atomenergoprom (AEP), is an exception to the three major groups. Atomenergoprom was established by the privatization of the Russian nuclear enterprises in 2007. AEP unified a government owned company and a civilian nuclear energy-related company. It is exploring a cooperative relationship with Toshiba.

Recently, there was a big incident of nuclear power plant order receipt in UAE and Vietnam. In UAE, the Korean companies' alliance led by National Power Corporation (KEPCO) received the order of nuclear power plant in 2009. This large and advantageous order presents 40 billion dollars (construction costs of approximately 20,400 million dollars and operation and maintenance expenses of approximately 20 billion dollars for 60 years).

Moreover, in Vietnam, the Russian national nuclear energy company РосАтом[8] decided to take the order. The relatively low price for a nuclear power plant and arms supplies represents the historical intimate relationship between the old Soviet Union and Vietnam.

Thus, the appearance as a driving force of the national strategy of both Russian state-owned enterprises and state monopoly enterprises, and the Korean government related company by the powerful backup of the government will significantly change the character of competition in the nuclear power industry.

7）Toshiba and Hitachi are companies with corporate governance that have the most open system of the company with committees among companies discussed in this paper.

8）"РосАтом is a national company which unifies all activities of the nuclear field including civilian and military. It includes a nuclear weapon section, research institution, nuclear safety section, and the radiological protection organization. Along with Atomenergoprom (AEP), it is one of the best in the civilian nuclear power generation industry." This description is based on RIST.

Although Japanese companies also tendered a bid, none received the order. Because of such incidents, Japan advocates for governments working together with the private sector. The efforts of private enterprises are very important, as are the efforts of a **consortium**[9] or an **international consortium**, which is led by private enterprise. Technological development in the next generation is dependent on private enterprise, and the role of leading Japanese companies in this enterprise is greatly anticipated.

2.2. Water: Decline of Major Water Company

The water industry differs greatly from the nuclear energy industry. The French private enterprise, **major water companies**, including Veolia Environnement and Suez Environnement, is leading the water industry. Other European companies are next in line. This industry is an important example of private enterprise leading a new high growth market. Water service in Japan is from a public utility, and Japanese companies (not shown in Table 2) fall behind in global competition.

World demand for quality water is rapidly growing because of economic development in newly emerging countries, urbanization, and a rapid growth of high-tech industries. The terms "**Water stress**" and "**Water scarcity**" are often used to describe the current situation. Water stress describes situations in countries where there is 1,000 to 1,700 m^3 of freshwater per capita per annum. Water scarcity is used when there is less than 1,000 m^3 of freshwater per capita per annum.

As shown in **Table 5**, *Pinsent Masons Water Yearbook 2009-2010* reports that there were 460 million people in water stress in 1995, and 170 million people in water scarcity. The same source predicts that the numbers will increase to 2,850 million people living in water stress and 800 million living in water scarcity in 2025.

Table 5. People living in areas of water stress and scarcity (million people)

	1995		2025	
	Countries	People affected	Countries	Peopleaffected
Water stress	24	460.0	48	2,849.5
Water scarcity	18	166.5	29	803.7

Source: Pinsent Masons LLP (2009).

9）A consortium is a group in which two or more companies form temporarily to achieve a large project needing sizeable capital. A consortium is considered one form of strategic alliance.
"Strategic alliance is a wide range and long-term cooperative relationship where the companies under competition have, based upon individual company business strategy." (Shimpo, 2009, 155-6).

Two French companies leading the water industry can be seen in **Table 6**. First, Veolia Environnement began business when Compagnie Générale des Eaux (GDE) won the concession for water supply to Lyons in 1853. Second, Suez Environnement began when Société Lyonnaise des Eaux et de l'Eclairage was founded in 1880. Both are private enterprises with very long histories.

These companies have continued the activity as a conglomerate representing France. Compagnie Générale des Eaux became Vivendi continued activities as a conglomerate, which extended its business in various fields. According to a study on French companies (Shimpo, 2001, Chapter 3)[10], Vivendi is ranked fourth.

In 2000, when **global mergers and acquisitions (M&A)**[11] became popular, Vivendi Universal was the merger of Vivendi, Canadian Seagram, and Canal+, which was an affiliate of Vivendi. This merger attracted global attention. Veolia Environnement was established independently from this company.

In 1997, Société Lyonnaise des Eaux et de l'Eclairage merged with Compagnie Suez. In Shimpo's study of French companies (2001, Chapter 3), Suez Lyonnaise des Eaux is tied for ninth rank with Vivendi. From Suez, Suez Environnment was separated out, and Suez Environnment purchased Agbar & AgVal, and expanded its water business.

A **conglomerate** is a company that is an aggregate of various business divisions whose industrial relationships are comparatively small. Although a conglomerate is influential in

Table 6. People served by company (million)

	1999	2001	2003	2005	2007	2009
Suez	81.7	94.7	104.2	104.5	100.4	90.0
Veolia	74.8	95.2	104.5	117.5	133.9	122.4
SAUR (Société d'Aménagement Urbain et Rural)	27.6	30.4	34.0	13.7	13.6	12.3
Agbar (Sociedad General de Aguas de Barcelona SA)	31.2	35.3	35.2	34.9	22.1	29.7
RWE	23.7	56.5	70.1	67.2	35.7	18.3
Total	**239.0**	**312.1**	**348.0**	**337.8**	**305.7**	**272.7**
Global	**350**	**430**	**490**	**565**	**681**	**802**
% by above	**68%**	**73%**	**71%**	**60%**	**45%**	**34%**

Note: These are net of cross-holdings, so Suez Environnement does not include Agbar.
Source: Pinsent Masons LLP (2009).

10）Shimpo (2001) compares the corporate governance in European countries, Latin American countries, Canada, and Australia with Japan and the U.S.

11）Regarding the brief history of M&A, refer to Shimpo (2009, 47).

advancing a new rapidly growing field, a risk by the low association will bring the difficulty to a company. A conglomerate often dissolves and concentrates on a specific business sector.

Veolia Environnement is large outside of France, in both the water service and the sewer businesses. In the water business, there are 24 million French customers out of a total 100 million customs. In their sewer business 16 million customers are French out of a total 64 million customs. Veolia Environnement business is China is increasing and has exceeded French business.

Because of the activity of Agbar, Suez Environnement has 15 million Spanish water customers and only 12 million French customers. Customers in China and Macao exceed the number of customers in France and Spain.

The two major French water companies have demonstrated overwhelming global power. However, because water demand is so great, both companies have declining market share world wide. As seen in **Table 7**, the largest company in 2009 was Veolia, with 120 million customers. When Sociedad General de Aguas de Barcelona SA (Agbar) is combined with Suez, Suez will be almost as large as Veolia. The market share of the top five companies dropped by half from 1999 to 2009, 68% to 34%.

In Germany, the large energy companies consist mainly of electric power and gas businesses. Companies such as E. On and RWE are good examples. E. On began in 2000 with the merger of VEBA and VIAG. E. On operates primarily in central Europe and obtains a large amount of sales through energy trading. RWE is ranked highest of energy companies in Germany and ranked second in the Netherlands and third in Britain.

As previously discussed, local government owns water service in Japan. Although the technological level is very high, management is not efficient, and privatization has begun.[12)]

1. **Privatization** is when government and local public managed companies are reorganized and managed by private enterprises.
2. If privatization brings about a joint stock company, the privatized company can obtain a large amount of investment capital through the financial and securities market and can more easily adapt to societal changes. The governments are freed from the burden of excessive investment and risk, and can return to their original role of administration. Market competition becomes more active, the quality of products and service is improved, and prices become determined by the entry of many companies into the industry.

12）Regarding water privatisation, refer to Finger and Allouche (2002).

Table 7. VEOLIA ENVIRONNEMENT SA と，SUEZ ENVIRONNEMENT SA

VEOLIA ENVIRONNEMENT SA

Veolia Environnement, profit and loss account

Y/E 31/12 (EURmillion)	2004	2005	2006	2007	2008
Turnover	22,500.3	25,570.4	27,941.0	31,932.2	36,205.5
Operating profit	1,480.6	1,892.9	2,124.2	2,482.5	1,951.3
Net profit	391.5	622.2	758.7	927.9	405.1
Earnings/share (EUR)	0.99	1.59	1.89	2.13	0.88
Dividend/share (EUR)	0.68	0.85	1.05	1.21	1.21

VE – Highlights

1853	Compagnie Générale des Eaux (GDE) wins concession for water supply to Lyons
1998	Générale des Eaux renamed Vivendi
2000	Partial flotation of Vivendi Environnement (VE) from Veolia Universal
2003	VE renamed Veolia Environnement, sale of Everpure

Population served in each country

Country	Water	Sewerage	Total
France	**24,500,000**	**16,200,000**	**24,100,000**
Germany	4,950,000	5,030,000	**5,050,000**
Mexico	5,980,000	3,450,000	**5,980,000**
USA	7,000,000	6,000,000	**14,000,000**
China	30,710,000	9,230,000	**35,050,000**
Total outside France	**77,116,000**	**47,592,000**	**97,874,000**
Global total	**101,616,000**	**63,792,000**	**121,974,000**

SUEZ ENVIRONNEMENT SA

Suez Environnement, profit and loss account

Y/E 31/12 (EURmillion)	2005	2006	2007	2008
Turnover	11,092.0	11,446.6	12,034.1	12,363.7
EBITDA	1,911.8	1,985.4	2,061.4	2,101.9
Operating income	999.8	1,060.4	1,061.4	1,059.1
Net income	659.4	573.8	491.7	533.0
Earnings/share (EUR)	1.35	1.17	1.00	1.09
Dividends/share (EUR)	N/A	N/A	N/A	0.65

Suez-Highlights

1880	Société Lyonnaise des Eaux et de l'Eclairage founded
1997	Merger with Compagnie Suez
2008	Suez Environnment spun off from Suez, acquires Agbar & AgVal stake

Suez, populations served by country

Country	Water	Sewerage	Total
France	**12,300,000**	**9,000,000**	**12,300,000**
Spain [1]	12,171,598	13,380,000	**15,000,000**
Chile [1]	6,591,116	6,468,873	**6,591,116**
Mexico	5,130,000	3,600,000	**7,300,000**
United States	7,350,000	4,125,000	**8,400,000**
China & Macao	14,700,000	1,000,000	**14,700,000**
Algeria	6,500,000	3,500,000	**6,500,000**
Saudi Arabia	6,500,000	3,000,000	**6,500,000**
Total outside France	**86,530,714**	**45,215,873**	**99,179,116**
Global total	**99,030,714**	**54,215,873**	**111,479,116**

Note[1]: Activities carried out by Agbar.
Source: Pinsent Masons LLP (2009).

3. To implement privatization, the following conditions must be improved: the development of the financial and securities market to handle stocks, the disclosure of sufficient financial information of a privatized company, and the wide range of individual investors and organizations that can purchase stock. Developing countries face difficulties privatizing their large state owned facilities.
4. Various transitional forms can be considered as privatization. **Private Finance Initiative (PFI)** is a new method[13] which utilizes private funds, executive ability, technical competence to build public facilities and perform maintenance management, among other tasks.

   Following privatization, the influence of government initially remains in the form of stockholding. It is critical to build governance which is open to the market influence, for example, the **company with committees** system in Japan.
5. The Thatcher Administration in Britain started privatization, and it gradually spread from the developed countries[14] to developing countries. After the Riemann shock in 2008 (see **Table 8**), privatization in developing countries has somewhat stagnated.[15]

Table 8. privatizations in developing countries

(US$ millions)

By region	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	**39,036**	**16,303**	**15,559**	**19,600**	**33,571**	**53,053**	**104,872**	**132,629**	**38,062**
East Asia & Pacific	10,780	1,659	1,830	8,136	8,037	14,708	51,230	74,161	13,408
Eastern Europe & Central Asia	12,252	7,062	9,806	7,028	14,800	27,148	35,528	40,852	16,722
Latin America & Caribbean	12,237	4,983	581	179	2,189	922	3,493	10,447	2,449
Middle East & North Africa	3,243	666	339	2,084	3,338	4,155	11,047	3,390	1,880
South Asia	61	486	2,289	1,297	4,663	3,799	1,649	1,343	1,878
Sub-Saharan Africa	463	1,447	714	876	544	2,321	1,925	2,436	1,725

(US$ millions)

By industry	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	**39,035**	**16,304**	**15,559**	**19,600**	**33,571**	**53,054**	**104,871**	**132,630**	**38,061**
Energy	9,311	1,818	887	1,662	10,897	2,201	19,939	22,247	...
Financial	5,405	3,808	942	6,586	5,905	15,542	48,932	60,573	1,423
Infrastructure	20,991	8,512	11,788	6,421	13,617	24,736	23,124	28,404	19,109
Manufacturing & Services	2,870	1,483	1,507	4,317	2,012	10,142	9,941	15,137	13,295
Other	2	4	3	6	...	...	...	...	...
Primary	456	679	432	608	1,140	433	2,935	6,269	4,234

Source: Sunita Kikeri and Matthew Perault, and World Bank Group (2010).

13）Refer to PFI Promotion Office, The cabinet Office of Japan (2010).

14）Nambu, Tsuruhiko, Eto Masaru and The Deregulation and Privatization Study Group (1994).

15）Regarding the developing-countries, refer to World Bank (2004).

Although Japanese companies have less experience in foreign operations than France does, there is an active movement by Japan to increase activities overseas. The Council on Competitiveness-Nippon (COCN) states that, "advanced technology is needed for water production, resurgent water, and advanced processing, and is possible through a technology oriented market. Focus is on the domains where Japanese companies have technological advantage and efficiency, such as desalinization of sea water, and drainage and reuse."[16)]

The Water Business Internationalization Study Group advocates that Japanese companies enter in the field of operation and management of traditional water supply and sewerage fields, along with growth fields such as reuse water, desalinization of sea water, industrial water, and industrial sewer.[17)]

The **major Japanese water company** is also active. Three companies are involved: Ebara, which has water supply and sewerage processing facilities, industrial water facilities and an effluent treatment facility; Mitsubishi Corporation, and JGC, an engineering business calling for a joint venture in the water disposal business. The formation of a consortium would be appropriate in this situation. In the process, a general trading company such as Mitsubishi Corporation would have a new role.

2.3. High Speed Rail: The Role of Privatization

Chandler describes the railroad as producing "the first modern company" (Chandler, 1977, 81). The Berle & Means type company, a company with market-centered corporate governance, was generated and developed in the railroad industry. Today, high speed rail produces businesses for a new generation and is an important industry to watch.

Railroad investment by developed countries has spread throughout the world and become a foundation for bringing economic development and infrastructure to other countries. Shimpo (2009, Chapter 4) discusses in detail Japan's railroad investment in the inter-war period and how it brought about modernization not only in Japan, but in China, Korea, and Taiwan as well.

The Japanese Shinkansen was developed in 1964, beginning a new period in rail history. France followed in 1981 with **high speed rail**[18)] which ran at the speed of more than 250 km/h. In the 21st century, the trend of high speed rail is spreading throughout the world. The popularity has increased because of the high consumption of energy and the environmental damage caused by

16）Council on Competitiveness-Nippon (COCN) (March 18, 2008).
17）Water Business Internationalization Study Group, (April, 2010).
18）This is based on the UIC definition.

airplanes, and because the high price of oil has increased airline ticket prices.

Table 9 shows high speed rail. The longest high speed rail line is the Tokaido Shinkansen which runs between Tokyo and Osaka. The fastest high speed rail line is the Beijing-Tianjin line which operates at 350 km/h. China also has the longest operation line. It is impossible to expect extensive improvement of speed in Japan rails because the geography of the country is prohibitive.

Japan, France and Germany build mostly main line high speed railways. China and other newly

Table 9. High Speed Lines in the World

Updated 21 May 2010
Lines or sections of lines in which operation V > 250 km/h

		In operation			Under construction	Planned	
FRANCE	LGV Paris Sud Est	300	1981 / 1983	419			
	LGV Est	320	2007	332			
				1,872	**234**	**2,616**	**4,722**
GERMANY	Fulda - Würzburg	280	1988	90			
	Nürenberg - Ingolstadt	300	2006	89			
				1,285	**378**	**670**	**2,333**
RUSSIA	Moscow - St. Petersburg	300				650	650
SPAIN	Madrid - Seville	270	1992	471			
	By pass Madrid	200	2009	5			
				1,664	**2,219**	**1,702**	**5,585**
UNITED KINGDOM	Fawkham Junction - Tunnel	300	2003	74			
	London - Southfleet Junction	300	2007	39			
				113			**113**
CHINA	Beijing - Tianjing	350	2008	120			
	Chengdu - Dujiangyan	250	2010	72			
				3,529	**6,696**	**2,901**	**13,126**
TAIWAN-CHINA	Taipei - Kaohsiung	300	2007	345			345
INDIA	Mumbai - Amehdabad	250				495	495
JAPAN	Tokyo - Osaka (Tokaido)	270	1964	515			
	Yatsuhiro - Kagoshima Chuo (Kyushu)	260	2004	127			
				2,452	**590**	**583**	**3,625**
SOUTH KOREA	Seoul - Daegu	300	2004	330	82		**412**
BRAZIL	Rio de Janeiro - Sao Paulo	300	2025			500	500
USA	North East Corridor ([Boston -] NY - W)	240		362		900	1,262
				13,414	**10,781**	**17,579**	**41,774**

Source: UIC High Speed Department (Updated 21 May 2010).

emerging countries are expected to advance high speed rail even further. The same trend is also seen in the United States and Britain as new business opportunity for railroad companies is available in high speed rail.

However, a large amount of investment is needed for a railroad business. The developed countries currently have large budget deficits, and countries such China do not necessarily have capital to spare. Developing countries face a difficult decision whether to give priority to high speed rail, which may enhance national pride, or to invest in other transportation or social needs.

If governments promote high speed rail as a national business and management is state run, then inefficiency will likely suffer and management may sooner or later come to a standstill. Management difficulties in the United States and Britain can be used as examples.

Japanese JR Central and JR East Japan are reported by Global 500 in FT 500. The privatization of JNR in 1987 succeeded in forming a new global railroad company. The leading railroad companies, French SNCF and German DB, are still state-owned or substantially state-owned, and they operate high speed rail. The Chinese railroad is also state-owned.

Table 10 shows the number of passengers of high speed rail in each railroad company. JR has

Table 10. Revenue-earning HS traffic in 2008

	Passengers (thousand)	Passenger-kilometres (in millions)	Mean passenger distance
	Total	Total	km
BE SNCB/NMBS	**9.697**	**1.079**	111
CZ CD	**915**	**253**	277
DE DB AG	**74.700**	**23.333**	312
ES RENFE	**22.955**	**10.490**	457
FI VR	**2.421**	**622**	257
FR SNCF	**116.054**	**52.564**	453
GB Eurostar UK	**9.100**	**993**	109
IT FS	**23.882**	**8.878**	372
JP JR	**310.237**	**81.658**	263
KR KORAIL	**38.016**	**10.158**	267
NL NS	**5.966**	**867**	145
PT CP	**1.795**	**525**	292
SI SZ	**109**	**14**	131
SE SJ	**8.764**	**2.992**	341
TW THSRC	**30.581**	**6.566**	215

Source: UIC - Statistics Centre (2009).

310 million passengers. SNCF has 120 million, and DB has 70 million passengers. The 2008 data does not include China. It is undeniable that the number of passengers is influenced by railroad management.

The world's three major railroad vehicle makers are Canadian Bombardier, French Alstom, and German Siemens. As Shimpo (2001, 221) shows, Canadian Bombardier is the world's largest maker of railroad vehicles. Bombardier also has aircraft business along that same scale. The dominant stockholder of this typical family business is the Bombardier family. Bombardier's stock market capitalization is not ranked in the Global 500.

Alstom is a leading French company involved in the power generation business and has played a big role in the production of high speed rail TGV. In 2006 the French conglomerate Bouygues acquired 23% of Alstom stock, which the French government had previously owned. The family holding company SCDM, governs approximately 20% of Bouygues. Siemens is a German company which has three sections: industry, energy, and healthcare.

Compared with European companies, the management of Japanese railroad vehicle companies is below standard. Hitachi has a large financial deficit and the Kawasaki heavy industries is not even ranked in the Global 500. On a positive note, the Kawasaki heavy industries has received high speed rail orders for the Shinkansen, China, and for the New York subway. In addition, Hitachi contributed to the development of the British high speed rail when the A-Train was exported to Britain. Nippon Sharyo Seizo, another railroad vehicle company, entered the arena with support from JR Central in 2008. JR Central is becoming a comprehensive railroad company.

The high speed rail industry has influenced the introduction of new technological innovations. Magnetic levitation transport, or maglev, is gradually becoming a reality. As shown in **Table 11**, the first trial of a new era high speed rail was the West German Prinzipfahrzeug, which got up to 90 km/h speed in 1971. The competition continues mainly between West Germany (currently Germany) and Japan, whose MLX01 got up to 581 km/h and become the fastest rail.

JR Central announced that free management and independency of investment can work to pay expenses. The plan is for service between Tokyo and Nagoya to begin in 2027 and service from Tokyo to Osaka to begin in 2045.[19] This is a historical event which garners much attention, the potential that private enterprise will build a new generation of high speed rail.

19）Central Japan Railway Company, (April 28, 2010).

Table 11. Speed Records

The history of maximum speed record by a trial run, in chronological order:

1971	West Germany	Prinzipfahrzeug - 90 km/h
1972	Japan	ML100 - 60 km/h - (manned)
1979-12-12	Japan	ML-500R - 504 km/h (unmanned) It succeeds in operation over 500km/h for the first time in the world.
2003	Germany	TR-08 - 501 km/h (manned)
2003	Japan	MLX01 - 581 km/h (manned/three formation) Guinness World Records authorization.

Source: International Maglevboard e.V. (2010).

2.4. Aircraft and Space Development: Progress in International Joint Development

Global warming caused by excessive energy consumption, the jump in oil prices, and other factors influenced a change toward lower energy consumption in the aircraft industry. If this technology does not advance quickly, the high speed rail may replace air travel for short distance travel.

But to lead in new technological innovations, such as new development in ICT, space development must advance. In fact, space development may become the new frontier for exploration.

The aircraft and space development is one industry in which Japan falls behind. This is in large part due to the defeat in World War II. Entry into the industry was severely restricted by the defeat, and Japan fell behind in global competition. Although Japan has somewhat caught up, the gap continues even today.

Table 12 shows a comparison of the scale of economic magnitude of the aerospace industry in each country. When we compare aerospace industry sales with the gross domestic product (nominal GDP), the sales ratio to GDP is 1.8% in France, 1.5% in Canada, and exceeds 1.3% in the U.S. Japan has the lowest ratio of those included, with only 0.3%. In addition, the aerospace industry employee to manufacturing industry employee ratio is 4.1% in Canada, 3.8% in France, over 3.6% in the U.S., and 0.3% for Japan.

As shown in Table 2, seven U.S. companies, two British companies, and one French company are the top ten companies in this industry. These nations were victorious in World War II. There is a large success gap between these companies and the Mitsubishi Heavy Industries, the Kawasaki Heavy Industries, and IHI.

Table 12. Economic and Industrial Situation in Each Country, Heisei 20/2008

			Japan	United States	Britain	Germany	France	Italy
Gross domestic product (Nominal GDP)	***1**	million dollars	**4,906**	**14,265**	**2,672**	**3,650**	**2,857**	**2,303**
Defense spending expenditure	*2	〃	46.3	607.3	65.3	46.8	65.7	40.6
								(estimation)
			0.9%	4.3%	2.4%	1.3%	2.3%	1.8%
Sales of aerospace industry	***3**	〃	**14.4**	**192.4**	**35.9**	**33.3**	**50.8**	—
			0.3%	1.3%	1.3%	0.9%	1.8%	
Export	*4	〃	783	1,287	469	1,454	603	536
Import	*4	〃	763	2,104	630	1,192	703	553
Number of employees	*5	thousand	63,850	145,362	29,475	38,734	25,913	23,405
Number of manufacturing industry employees	*5	〃	11,740	15,904	3,547	8,516	3,877	4,805
Number of aerospace industry's employees	***3**	〃	**31**	**580**	**101**	**93**	**147**	—
			0.3%	3.6%	2.8%	1.1%	3.8%	
Average exchange rate (1U.S. dollar) in 2008	*6		103.45	1.00	0.5449	0.6832	0.6832	0.6832
			(Yen)	(US $)	(£)	(€)	(€)	(€)
			Spain	Canada	Russia	China	South Korea	Brazil
Gross domestic product (Nominal GDP)	***1**	million dollars	**1,604**	**1,500**	**1,677**	**4,327**	**929**	**1,576**
Defense spending expenditure	*2	〃	19.2	19.3	58.6	84.9	24.2	23.3
					(estimation)	(estimation)		
			1.2%	1.3%	3.5%	2.0%	2.6%	1.5%
Sales of aerospace industry	***3**	〃	**9.8**	**22.1**	—	—	**1.9**	**7.6**
							(2007)	
			0.6%	1.5%			0.2%	0.5%
Export	*4	〃	276	459	468	1,429	422	198
Import	*4	〃	413	415	267	1,133	435	173
Number of employees	*5	thousand	20,258	17,126	70,965	774,800	23,577	90,786
								(2007)
Number of manufacturing industry employees	*5	〃	3,060	2,041	11,663	—	4,119	13,105
							(2007)	(2007)
Number of aerospace industry's employees	***3**	〃	**36**	**83**	—	—	**8**	**27**
			1.2%	4.1%			0.2%	0.2%
Average exchange rate (1U.S. dollar) in 2008	*6		0.6832	1.0660	24.8593	6.9509	1,099.2	1.8337
			(€)	(CND$)	(Ruble)	(Yuan)	(Won)	(Real)

Source *1 Economic and Social Research Institute, Cabinet Office (Japan) (nominal calendar year), JETRO, J-File (each country).
*2 SIPRI (Military Expenditure).
*3 (Japan) Ministry of Economy, Trade and Industry, Machine Statistics, Industrial Society's investigation, and Annual Report and Facts & Figures in Overseas industrial society in each country.
*4 (Japan) Ministry of Finance, Trade Statistics of Japan (report announcement data, calendar year), JETRO, J-File (each country).
*5 International Labour Office (ILO)_Yearly data.
*6 IMF International Financial Statistics, PACIFIC Exchange Rate Service.
Original Source: The Society of Japanese Aerospace Companies (2010a).

Table 13 shows statistics on the same industry, but, Table 13 differs considerably from Table 12, which shows different sales categories. Airbus, under the influence of European Aeronautic Defense and Space Company N.V. (EADS), is shown as independent. United Technologies is treated as an engine maker. General Dynamics, Raytheon, and Precision Castparts are not reported. Table 13 considers only the aircraft and the space development sections, while Table 2 considers the sales of the entire company. Table 13 shows many companies, such as Bombardier and Embraer, which are not high stock market capitalization companies.

One important point is that **European companies**, such as EADS and Airbus, are listed first. The influence of the European integration is seen here. That is, they are European companies with

Table 13. Production and Sales of World Representative Aerospace Manufacturers in the World

1. Entire Production and Sales of Aerospace Manufacturers (US$ mil.)

		'00	'02	'04	'06	'08
EADS	Europe	22,303	28,139	39,464	43,826	63,327
Boeing	United States	51,321	54,061	52,457	61,530	60,909
Lockheed Martin	United States	25,329	26,578	35,526	39,620	42,731
Airbus	Europe		18,363	25,129	31,602	40,183
BAE Systems	Britain	18,437	18,202	24,208	25,322	34,030
Northrop Grumann	United States	7,618	17,206	29,853	29,991	33,887
MHI	**Japan**	**24,475**	**17,320**	**19,391**	**20,863**	**25,589**
Bombardier	Canada	9,170	13,902	11,696	14,781	17,506
Embraer	Brazil	2,762	2,526	3,441	3,835	6,335
Total		**161,415**	**196,297**	**241,165**	**271,371**	**324,497**

2. Aircraft Engine Production and Sales of Aircraft Engine Manufacturers (US$ mil.)

		'00	'02	'04	'06	'08
General Electric	United States	10,779	11,141	12,500	13,153	19,238
Rolls-Royce	Britain	8,838	8,009	10,035	12,208	15,052
United Technologies	United States	7,366	7,645	8,303	11,113	12,965
Honeywell International	United States	4,300	3,500	4,900	5,500	5,800
SNECMA	France	3,004	3,482	4,191	5,012	5,365
MTU Aero Engines	Germany	1,941	2,107	2,476	3,030	3,986
Japan(IHI, KHI, MHI)	**Japan**	**2,410**	**2,146**	**2,698**	**3,241**	**3,816**
Avio	Italy	784	848	1,297	1,477	1,979
Turbomeca	France	429	565	829	1,091	1,507
Volvo Aero	Sweden			942	1,090	1,129
Total		**39,851**	**39,444**	**48,171**	**56,916**	**70,837**

Source: The Society of Japanese Aerospace Companies (2010c).

alliances and unions with the private enterprises in Europe, and they are quite dependent on the state policy of the European countries.

In 2000 EADS was established by the integration of French Aerospatial Matra, German Daimler-Chrysler Aerospace (DASA), and Spanish CASA. Airbus is EADS's biggest section. The stockholders of EADS are Lagardere and French state holding company Sogepa (Sogeade) with 22.46%, Daimler also with 22.46%, and Spanish state holding company (SEPI) with 5.48%. Although EADS is at the top of the class in assets and sales (see Table 2), it is in the red in this fiscal year, its stock market value is the relatively low, and its management is troubled.

Reorganization and integration of companies is also occurring in the U.S. and Britain. Boeing united with McDonnell Douglas. Lockheed Martin was the integration of Lockheed and Martin Marietta. Northrop Grumman is a combination of Northrop and Grumman. British BAE Systems was the integration of British Aerospace (BAe) and GEC Marconi. In this industry, reorganization and integration is dynamic because of huge capital volume and risk, as discussed with the nuclear power industry.[20)]

Japanese companies do not follow the same trend. As an aircraft and space development industry, Mitsubishi Heavy Industries is ranked seventh. As an aircraft engine maker, three Japanese companies together also rank seventh. The movement toward reorganization and integration among Japanese companies is slow. To win global competition, Japanese companies must make important decisions about forming alliances between Japanese companies, with the United States, with the European companies, and with Asian companies even though alliances with Asian companies are potentially difficult alliances.[21)]

Table 14 lists **international joint development** in the military aircraft and engine industry from the year 2000 forward. In the military aircraft field, there is international joint development for the F-35 fighter (U.S. Lockheed Martin and British BAE Systems). The Trent 1000 engine of the B787 is jointly developed by Rolls-Royce (Britain), the Mitsubishi Heavy Industries, Kawasaki Heavy Industries (Japan), and ITP (Spain). For the GEnx engine, GE and IHI have worked together.

Japanese companies have been significantly involved in the international joint development of a new generation of aircraft, the Boeing B787. Three companies, Mitsubishi Heavy Industries, Kawasaki Heavy Industries, and Fuji Heavy Industries, have taken part in the 787 Dreamliner

20）The Society of Japanese Aerospace Companies (2010b).

21）There is cross shareholding between Japanese companies and Korean companies in the steel industry.

Table 14. International Joint Development

1. International joint development for a military aircraft

First flight	Model name	Engine	Maximum speed	Company in charge	(Nationality)
August, 2002	T-50 training plane / attack plane	F404-GE-102 8,027kg × 1	Mach 1.4	KAI Lockheed Martin	(South Korea) (United States)
December 1, 2009	A400M transport plane	TP400 10,000 ～ 13,000shp × 4	Mach 0.72	EADS Airbus CASA BAESystems TAI Flabel	(Germany) (France) (Spain) (Britain) (Turkey) (Belgium)
from 2010 onward	F-35 fighter (JSF program)	P&W F135 17,790kg × 1	Mach 1.6	Lockheed Martin BAE Systems	(United States) (Britain)

2. Major international joint development for engine

Type approval (authorization) year	Engine	Loading model	Development company (nationality)	(Nationality)
2000	Trent 500	A340-500/-600	Rolls-Royce FIAT ITP IHI, Kawasaki Heavy Industries Others	(Britain) (Italy) (Spain) (Japan)
2004	CF34-10	EMBRAER 190, 195	GE Japanese Aero Engines Corporation	(United States) (Japan)
2005	PW6000	A318	Pratt & Whitney Mitsubishi Heavy Industries	(United States) (Japan)
2007	Trent 1000	B787	Rolls-Royce Mitsubishi Heavy Industries, Kawasaki Heavy Industries ITP	(Britain) (Japan) (Spain)
2008	GEnx	B787	GE IHI	(United States) (Japan)

Source: The Society of Japanese Aerospace Companies (2010b).

program and will take charge of 35% of the body. Toray Industries will provide carbon composite material for a main structural part.

This is a dynamic time for Japanese companies in the aircraft field. Mitsubishi Heavy Industries has started manufacturing the regional jet Mitsubishi Regional Jet (MRJ) as a Mitsubishi Aircraft. Honda developed the small business jet aircraft, the HondaJet, by combining an in-house made body (with few global compatibles), and an in-house made engine, Honda's HF118 turbofan engine.

A new achievement in space development is the HIIA rocket by Japan Aerospace Exploration Agency (JAXA) and Mitsubishi Heavy Industries. This rocket was developed to meet a number of transportation demands with low cost and high reliability, such as the launch of an artificial satellite and supply delivery to the International Space Station. HIIA boasts a good initial cost to performance ratio by holding down launch costs by 50%. Cost reduction is achieved through simplification of design, efficiency of manufacturing, and launch procedures.

The management of the launch business, for the H-IIA launch vehicle, was transferred to Mitsubishi Heavy Industries, and JAXA is implementing the launch safety supervision. Private enterprises are also taking a lead in the business, and NASA (U.S.) is considering privatization of space development.

Mitsubishi Heavy Industries won the contract for launch transport service for multi-purpose satellite No. 3 (KOMPSAT-3: Korea Multipurpose Satellite-3). The contract was previously held by Korea Aerospace Research Institute (KARI). This is the first time that Mitsubishi received an order for a satellite launch from overseas. The launch is scheduled for the 2011 fiscal year. Japanese companies are finally becoming more active in meeting the increasing space development needs.

Despite increased involvement, Japanese companies remain a small part of the field, and there is significant competition from other companies. The important question is how Japan can take its private enterprise expertise in the auto and electrical machinery industries, which led the Japanese postwar economy, and apply its private enterprise expertise in a new industry.

Ⅲ. Conclusion: The significance of Private Enterprise-led Investment in Global Competition and the Role of Japanese Companies

Figure 2 summarizes the characteristics of four industries. First, it is important to note that a host country is cautious about being governed by those in charge of infrastructure investment, but a

	Electric Power (Nuclear Power Generation)	Water	High Speed Rail	Aircraft and Space Development
Industrial structure	Concentration on three groups	Dispersion from two companies	Concentration on the country's specific companies	Concentration on the country's specific companies
Leading company	Centered on private enterprises	Major water company (private enterprises) vs. the national and local governments	Centered on state-owned enterprises	Centered on private enterprises, partly government related company (Europe)
Trend between companies	M&A, the alliance between major companies	Does consortium develop?		M&A, international joint development
FDI	Possibility of development	Possibility of development	Problem outbreak regarding technology transfer	Minimal FDI
Japanese companies	Japanese companies in three groups	No private enterprise in this industry	JR is a privatized company	Considerably inferior level, private enterprises

Figure 2. Characteristics of Four Industries

host country is enthusiastic about introducing the management resources of a developed country. It is not necessarily clear whether the form of the FDI with a high ownership ratio of increases.

To avoid total rule by a developed country company, as in the Chinese railroad industry, the management resources of two or more developed country companies can be combined. However, there is a danger of two or more technologies not integrating well together.

FDI in the water industry is local and will not easily become a political issue. Therefore, there is a possibility of FDI increasing. In contrast, since the aircraft and space development industry has a national defense character, there is not as much FDI as compared to the other industries discussed. There are exceptions in European companies where economic and political integration has been attained, and in countries with a history of long alliance, such as Japan and the U.S.

The four industries share common features. The four major infrastructure industries all require large amounts of investment and investment risk is high. M&A is dynamic in these industries and it strengthens competition. Many countries see the infrastructure industry as a key industry. The government often tries to privatize infrastructure. However, because some state-owned enterprise is poorly run, privatization is not easy. To win global competition, some situations in which the government controls will be expanded. For example, developing country state-owned enterprises have newly entered into competition.

First, global competition is becoming increasingly characterized by competition between private enterprise and government related companies. If state-owned enterprises, state monopoly enterprises, and sovereign wealth funds become dominant, the strong national powers will interfere with the economy, and markets will be monopolized for the profit of specific counties. Free competition in the global market will be obstructed. The most typical examples are found in natural gas (Russia) and rare earth (China). The same concept also applies to the four industries discussed in this paper.

In addition, the rule by state-owned enterprises, state monopoly enterprises, and sovereign wealth funds will stagnate individual country economies as well as the global economy. The quality of infrastructure will be degraded by spreading management inefficiency into the global market.

Examples are the socialism based on the state-owned enterprises that dramatically collapsed in the second half of the 21st century, and the developing countries, having mainly state-owned enterprises, worked closely with socialist countries and policies deadlocked. In developed countries, infrastructures controlled by the states, such as communication, postal service, and railroad, could not adapt in time for the ICT revolution. Consequently privatization occurred. Privatization is not universal, and has had successes and failures.[22] However, it is impossible to return to long-term nationalization.

Second, as development of infrastructure industry grows, it brings about a new business organization model. Just as the railroad industry produced the first modern company, the process of building a new generation's infrastructure will produce a contemporary company suitable for a global economy.

For example, the contemporary company performs cross-border M&A primarily through the market system. Shimpo (2009, Chapter 5, 1.3) explains that M&A is a new form of FDI that exceeds green field investment, which was previously dominant. Newly combined companies turn into companies based on the global market, and large-scale financing is available through that market.

The new involvement of private enterprise with the **international joint development** and **international consortium** is attracting attention. To build a large-scale infrastructure, there is cross over among many industries. A good example is the international joint development in the

22）Roland, Gérard edited, foreword by Joseph E. Stiglitz (2008).

aircraft and space development industry. As long as international joint development maintains the autonomy of companies and of the activities of participating countries, there will be little conflict, and the possibility of global competition will increase.

Third, the Japanese companies examined in this paper are private enterprises, with the exception of the water service business and privatization which recently succeeded in the railroad enterprise. In the water service business it is expected that there will soon be the appearance of a major private Japanese water company covering multiple industries.

The above Japanese companies are not only private enterprises, but their corporate governance is market-centered. There are no state-led companies or family-led companies, like those often found in French companies.[23] For the Japanese companies, character becomes their advantage. The corporate governance of U.S. and British companies is also primarily market-centered. Some industries such as the railroad industry, which once supported the economy of both countries, are changing to the state-led model as the industry declines. Although not addressed in detail here, the large state-owned enterprises and state monopoly enterprises in China and Russia, such as Atomenergoprom, are taking an increasingly large role.

Finally, I would like to emphasize the most important conclusion in this paper. In the above industries, the role of state-led investment increases gradually, the private enterprise led global competition is likely to retreat. In these conditions, Japanese companies are gaining more presence, and are being asked to lead the **private enterprise led global competition**. Even in Japan, as I have discussed in Introduction, there is an argument that governmental role should be increased to compete with the developing countries. However, limiting the governmental role strengthens the framework of private competition. Even when state support is needed, its role should be indirect.

There is the similar discussion on the role of the Government in the Japanese international position. As there is a rapid **appreciation of yen**, some in Japan feel that the appreciation of the yen should be prevented through exchange intervention. However, the appreciation of the yen is the reflection of Japanese advantages and is not caused by exchange speculation. Currently, the scale of the international financial market is too large and the effect of exchange intervention is temporary

23）Shimpo (2009) demonstrated that, unlike the popular view, Japanese corporate governance from the prewar period to the present has been market-centered.

and restrictive. The most realistic approach is to efficiently and constructively use the current appreciation to invest in cross-border M&A in promising industries, and to advance the conversion of industrial structures. Due to M&A, much of the global business discussed in this paper is growing rapidly.

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