Section 3 Intangible assets and economic growth

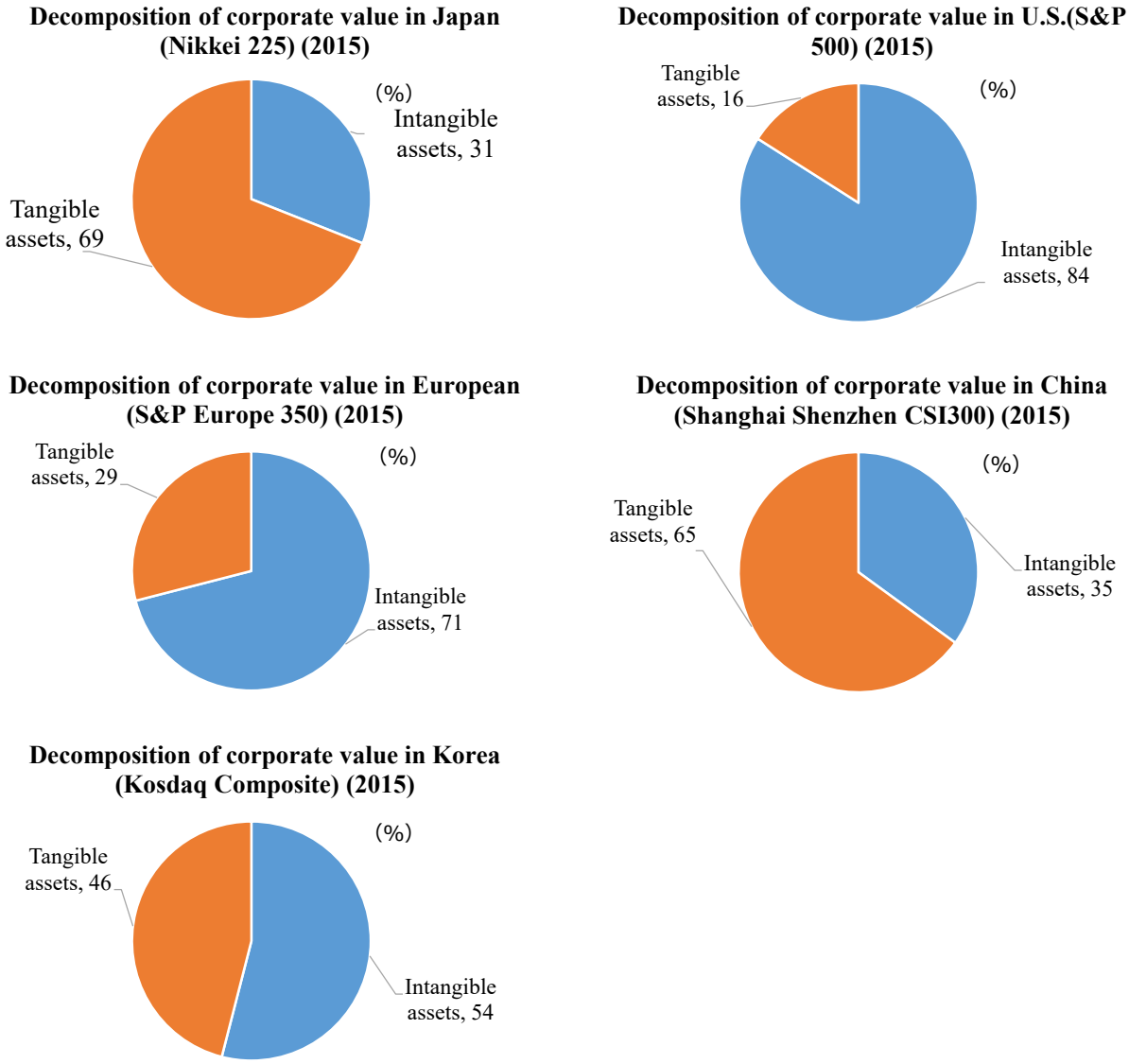
This section examines the importance of investment in intangible assets (to be defined and detailed later) for companies to gain the advantage in competition, as a way of showing the economic growth brought about by innovation. The leading-edge industries, which are expected to grow in the future market, are those created by technological innovation. In particular, in the information technology field, the competitive advantage of so-called platform companies with a dominant position in the market is formed by investment in intangible assets such as research and development. This section will discuss the importance of intangible asset investment in advanced technology industries, the role of intangible asset investment in the profit trends of platform companies, the importance of financial systems to promote innovation, the comparison of intangible asset investment in some advanced countries, and the importance of open innovation as a factor of promoting intangible asset investment.

1. The importance of intangible asset investment, as suggested by the expansion of the market size of advanced technology industries s

Conceptually, investments made by companies can be classified into two main categories. The first is investment in tangible assets, and as the name suggests, it is investment in real production facilities such as machinery, equipment, and structures such as factories. The second is investment in intangible assets, whose famously known category is research and development (R&D). Although intangible asset investment is difficult to measure and visualize, it has an important impact on production activities.

According to Elsten and Hill (2017), the decomposition of the market value of companies listed in the S&P 500 resulted in, as of 2015, 84% as intangible assets, and in the S&P Europe 350 resulted in 71% as intangible assets, while the ratio of intangible assets to corporate value in Asian countries, including those of companies listed in Japan's Nikkei 225, is relatively low (Figure II-2-3-1). As can be seen below, it is important for companies to increase intangible asset investment, such as investing in new ideas, in order to find business opportunities amid the expected rapid expansion of markets related to emerging technologies. The relatively low proportion of intangible assets in the corporate values of Asian countries, including Japan, suggests that it is important to increase the proportion of the intangible assets in order to establish a corporate presence.

Figure II-2-3-1. Ratio of intangible and tangible assets to corporate value in each country

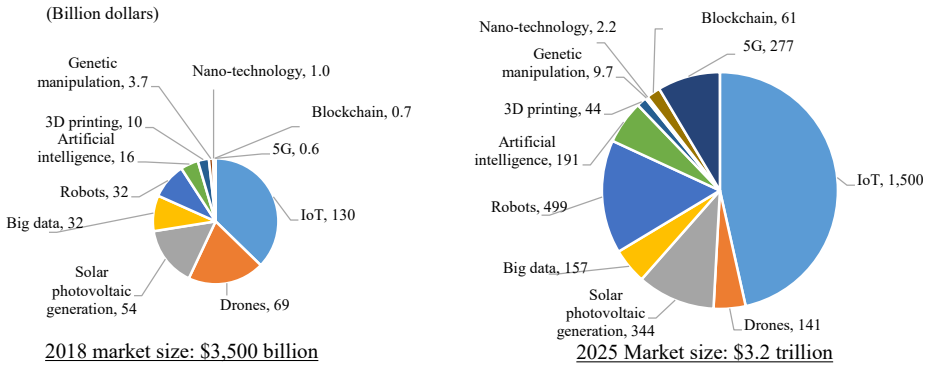


Source: Ministry of Economy, Trade and Industry based on Elsten & Hill (2017).

According to a report by the United Nations Conference on Trade and Development (UNCTAD), the market size of advanced technology industries is expected to grow 9.1-fold from $350 billion to $3.2 trillion from 2018 to 2025 (Figure II-2-3-2). Over the same period, the IoT market is expected to grow significantly from $130 billion to $1.5 trillion (11.5 times), robot market from $32 billion to $499 billion (15.6 times), and AI market from $16 billion to $191 billion (11.9 times). Although the current market size is relatively limited, blockchain market is expected to grow rapidly from $700 million to $61 billion (87.1 times), and 5G market from $600 million to $277 billion (461 times). For companies, there can be various competitive strategies such as the role of producers of final goods in these advanced technology industries and the inclusion of themselves in the value chain by providing materials to those industries. However, it is essential for companies to participate in rapidly expanding

markets, and investment in intangible assets such as research and development will be more important in order to survive in markets where high technology is required.

Figure II-2-3-2. Market size of advanced technology industry



Source: *Technology and Innovation Report 2021* (UNCTAD).

2. Intangible asset investment as a source of market power for platform companies

Looking at trends in so-called platform companies in advanced technology industries, although there is no clear definition of platform companies, they are called plat form companies if it is essential to use their services for conducting economic activities[193]. For example, if a retailer uses the services of a company that operates a large online sales website to attract more shoppers, a company that operates such a large online sales website will be called a platform company. An important question is how such platform companies can form a position that their services are essential to other companies.

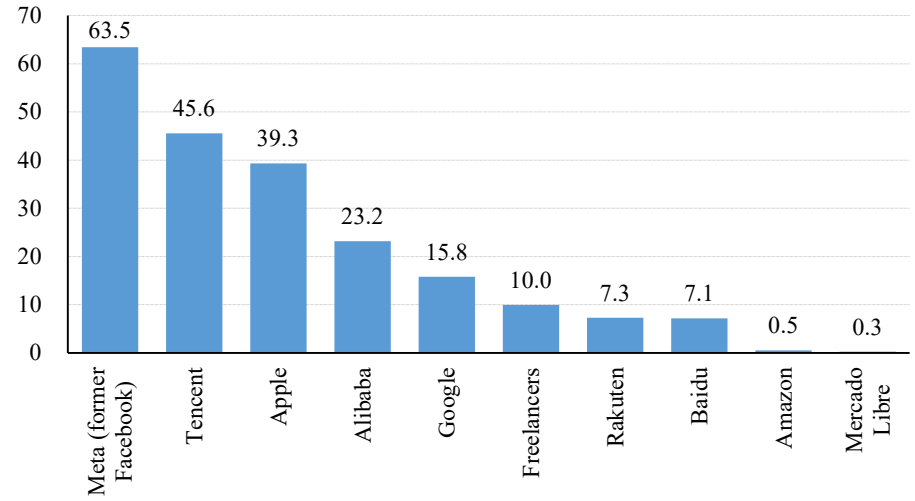
The following (Figure II-2-3-3) compares the net income per employee of companies considered as platform companies in the OECD report, and shows that Amazon, the leading platform company in the United States, has a particularly low net income per employee. On this point, Lina Khan, the Federal Trade Commission (FTC) Chair in the United States, pointed out when she was a student at Columbia Law School, that there was no problem even when Amazon's management indicators, such as net income per employee, were sluggish because of the consensus among shareholders and other stakeholders that large amounts of sales were used to develop technology to establish market power[194]. In other words, the paper implied that investment in intangible assets such as research and development is an important factor in gaining and maintaining market power.

[193] For example, the Report on the Study of Legal Issues surrounding Platformers, which is a FY2017 project commissioned by the Ministry of Economy, Trade and Industry, exemplifies the characteristics of platform companies defined by the European Commission and the Japanese Ministry of Internal Affairs and Communications.

[194] Khan (2017).

Figure II-2-3-3. Net income per employee of major platform companies (2017)

(Purchasing power parity: $10,000)



Note 1: NET income is on a group-wide basis (except for Google, which is based on the Google division within Alphabet Inc.).
Note 2: Facebook is now known as Meta.
Source: *OECD Digital Economy Outlook 2020*.

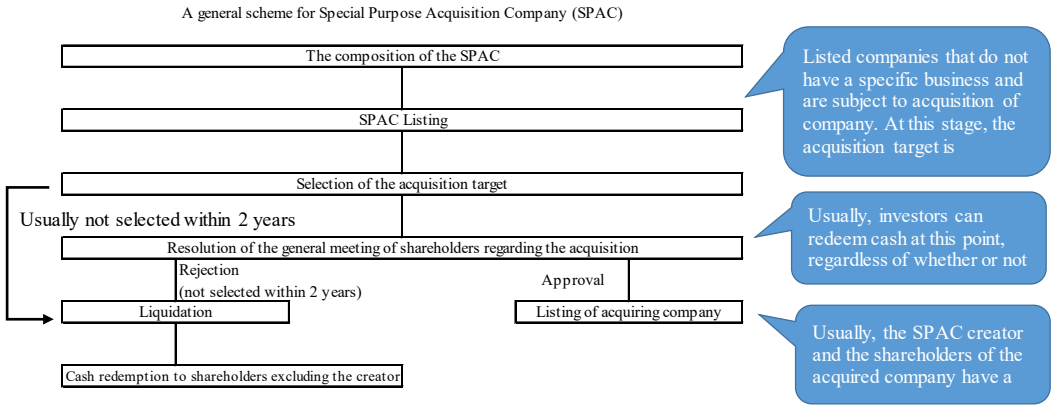
3. Financial markets to boost innovation

In the advanced technology industry, because the technology handled is new, it may not be generally recognized, and therefore is difficult to be evaluated. The same is true for companies specialized in those technologies and they usually face difficulty in raising funds through indirect financing such as borrowing from banks or through conventional direct financing by issuing shares.

Funding through SPACs (Special Purpose Acquisition Companies) has been recently emerging as one of the important financing methods for emerging companies especially in the United States[195]. This method aims to raise funds by listing companies that have no core business, and then acquire unlisted companies within a certain period of time. It is an important mechanism for emerging companies that are difficult to raise funds on their own (Figure II-2-3-4).

[195] The explanatory materials for the first meeting of the Study Group on SPAC, which was established by the Tokyo Stock Exchange, held on October 1, 2021, describes discussions on the advantages and disadvantages of SPACs in the United States and other countries. One of the advantages for operating companies is an opportunity to be listed for companies in new fields, such as space and mobility.

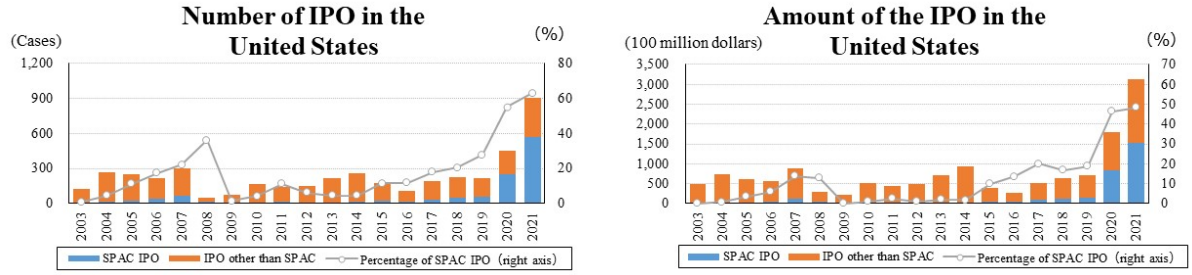
Figure II-2-3-4. Conceptual diagram of SPAC funding



Source: Materials of the Tokyo Stock Exchange.

Since 2020, when the COVID-19 pandemic worsened, the number of initial public offerings (IPOs) using the SPAC scheme has increased significantly in the United States, suggesting that fund-raising needs of companies with new technologies and ideas were high under the situation where the social structure that suppresses contact-based economic activities had to change (Figure II-2-3-5). Thus, financial infrastructures are developed to encourage innovation by emerging companies, so that they can serve as a basis for promoting opportunities for the creation of new products and services.

Figure II-2-3-5. Number of SPAC's IPOs (left figure) and amount of IPOs (right figure)



Source: SPAC Analysis.

Examples of companies that are listed using the SPAC scheme and have a high rate of return on "unit" issued at the time of listing (Table II-2-3-6) include Primoris and Archaea Energy that are related to renewable energy, MP Materials, HighPeak Energy, and Magnolia Energy that deal with natural resource extraction, QuantumScape that develops high-performance all-solid-state batteries, and Cerevel Therapeutics that develops therapies for neurologic diseases. The table shows that their various ideas and technologies have been evaluated in the financial markets, enabling them to raise funds.

Table II-2-3-6. Listed companies in the United States by SPACs with a high rate of unit return

Company name	Main business	Unit return (%)

Iridium	Satellite communications communication	571
Digital World / Trump Media	Social networking, digital streaming	508
Lucid	Electric vehicle development	491
MP Materials	Mining and processing of rare earths	432
Tecnoglass	Manufacture of architectural glass and related aluminum products	425
Grid Dynaimcs	Digital transformation consulting	408
Primoris	Special construction and infrastructure projects such as plants, pipelines, and water businesses related to renewable energy	378
Enovix	Development of 3D silicon batteries	338
Simply Good Foods	Development of health-conscious foods	338
PLBY Group	Events for and sale of apparel and cosmetics	285
DraftKings	Fantasy sports, sports gambling	278
Kennedy-Wilson	Real estate investment	260
Betterware	Sale of furniture, home appliances, and daily necessities	254
QuantumScape	Development of all-solid-state batteries	252
Matterport	Development of tools for creating digital twins in real space	251
Vertiv	Design of infrastructure management systems such as data centers and communication networks	191
Beauty Health	Sale of cosmetics, skincare services	190
Clarivate	Data provision and consulting on academic research, patents, biotechnology, trademark and domain management	178
ChargePoint	Popularization of electric vehicle charging networks	175
Retail Opportunity	Investment in retail store real estate	168
Lazydays	Buying, selling, and renting recreational cars such as campers	159
Open Lending	Provision of automated risk assessment models for financial institutions relating to automobile loans	154
AerSale	Sale, lease, repair and maintenance of aircraft and parts	139
Porch	Provision of a platform for housing-related services	133
Stem	Provision of energy storage technology and related solutions	131
Archaea Energy	Production of renewable natural gas (RNG) through the use of landfill waste disposal sites	123
Repay	Provision of a payment system for financial transactions	110
AdaptHealth	Sale and lease of medical equipment	108
Tattooed Chef	Production, processing, and sale of agricultural products	95
SoFi	Social lending	76

Note 1: Accessed on April 22, 2022.
Note 2: "Unit" is a security combining common shares and warrants that are issued by SPACs in order to raise funds.
Source: SPAC Analysis.

4. Comparison of intangible asset investment of major countries

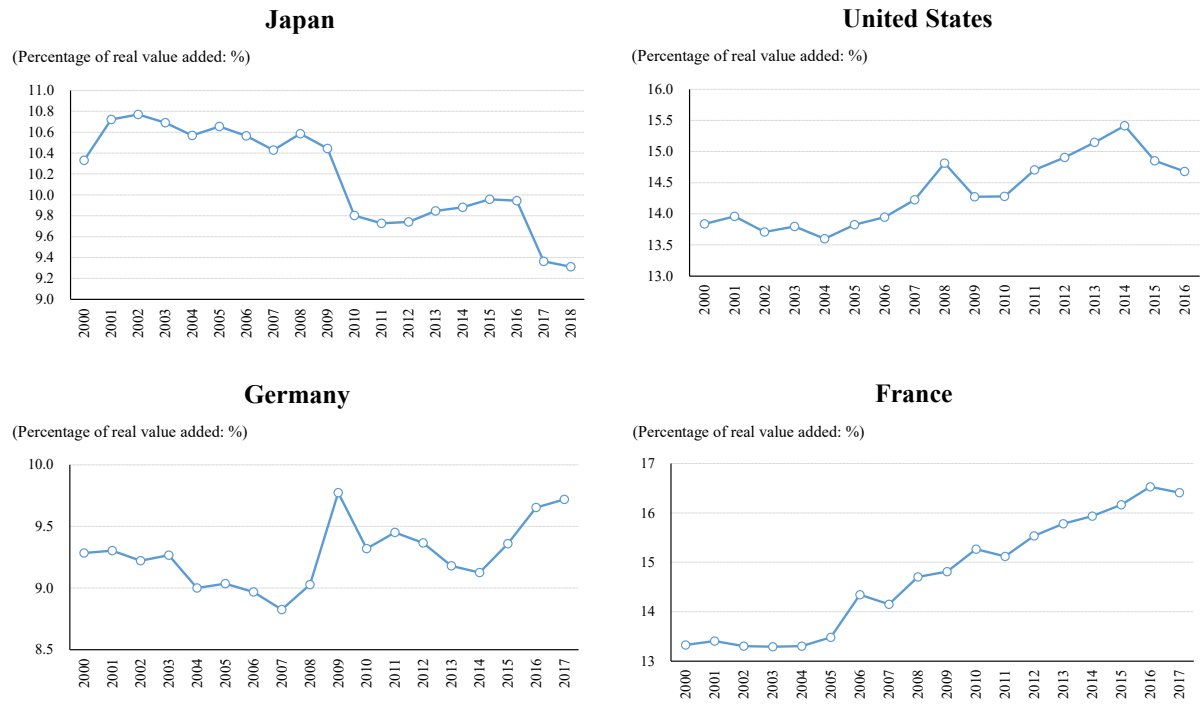
Given the importance of intangible assets, the National Accounts Statistics, which is an on-going accounting manual to estimate gross domestic product, is compiled based on the international standard adopted by the United Nations. In the on-going statistics, intangible asset investment only includes investment in R&D, computer software, original materials of entertainment works while broader

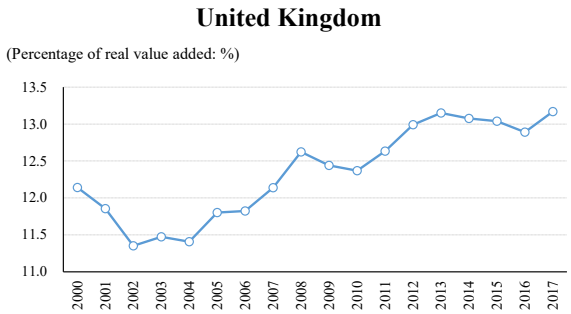
definition of intangible asset investment covers more items. Specifically, training for employees to improve the level of skills and knowledge is expected to improve labor productivity, and can be regarded as intangible asset investment in a broader sense. This section examines the differences between countries in intangible asset investment in a broader definition.

Although the scope of intangible asset investment is not clearly defined, this section refers to INTAN-invest, which is a database of intangible asset investment for Europe and the United States, and the Research Institute of Economy, Trade and Industry for Japan. Specifically, both data include software databases, original works of art or literature, mineral exploration, designs, product development in the financial industry, research and development, brand, organizational reform, and human capital as intangible asset investment.

The figures below (Figure II-2-3-7) show the total amount of real intangible asset investment as a real value-added ratio in some developed countries. According to the figures, while the ratio in the United States has been declining for two consecutive years since 2015, the ratio other than Japan has been rising moderately from longer-term perspective.

Figure II-2-3-7. Real value-added ratio of real intangible asset investment

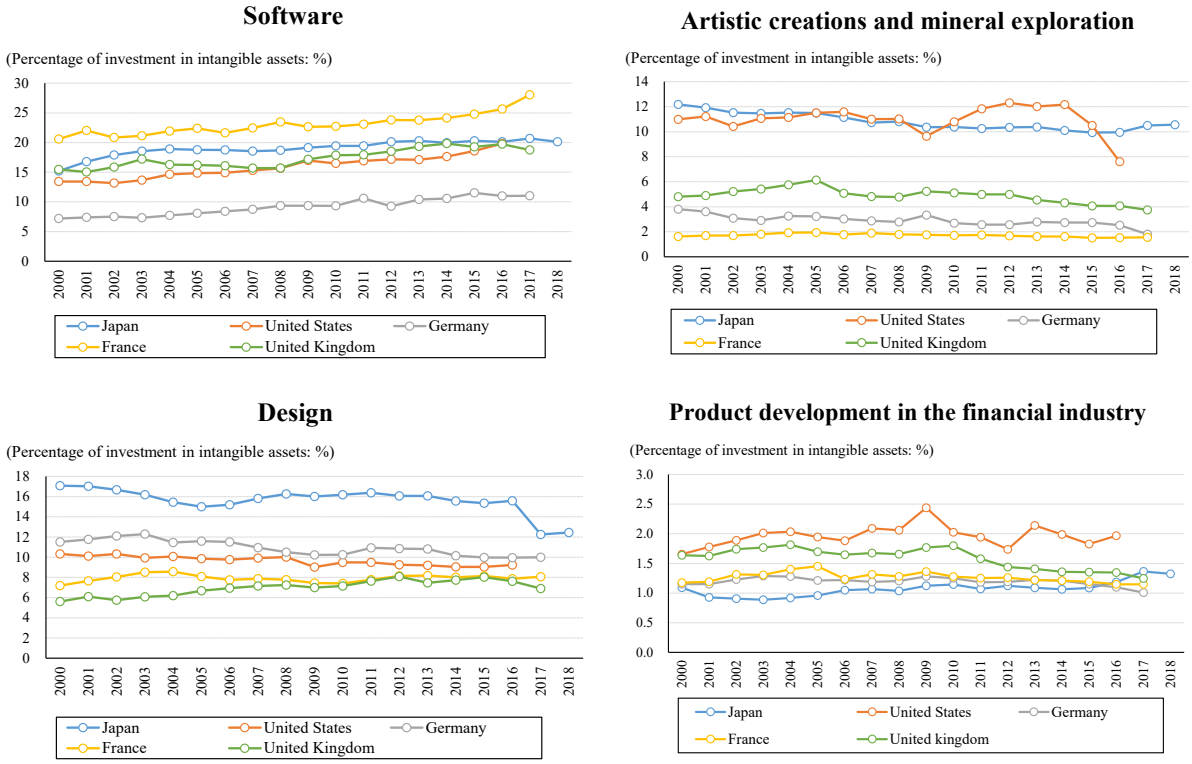


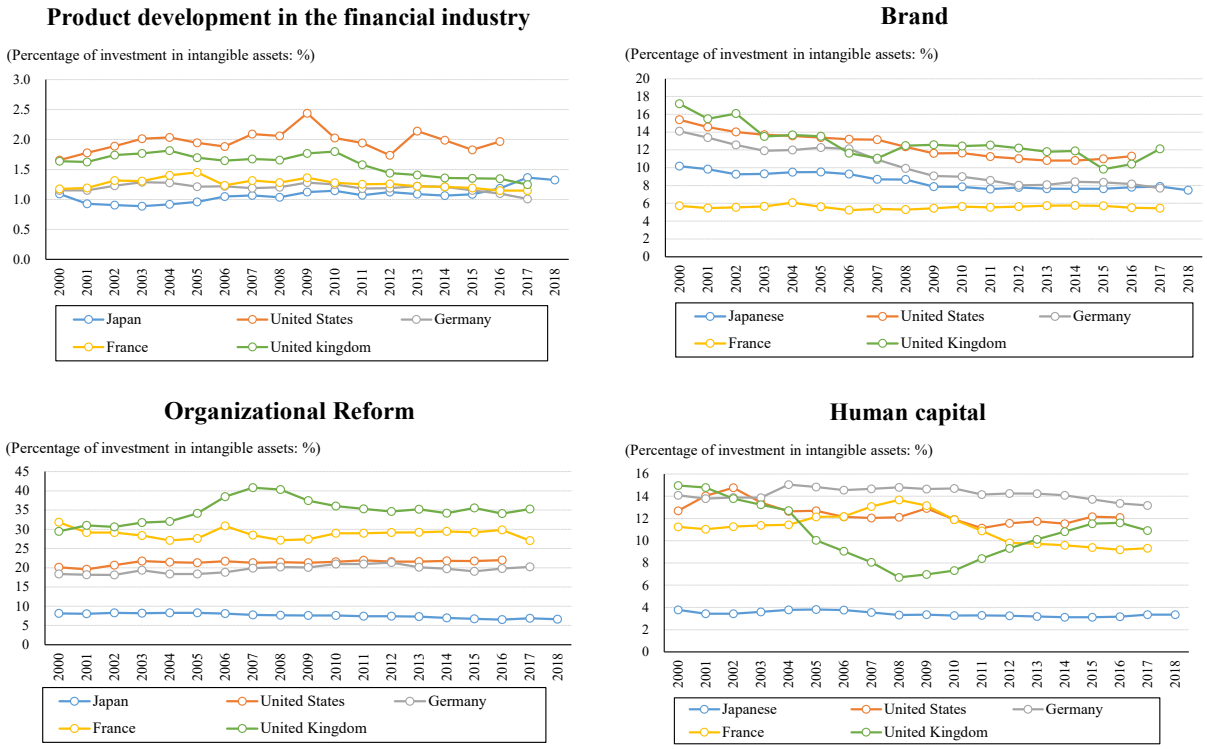


Sources: Research Institute of Economy, Trade and Industry for Japan, and INTAN-Invest for other countries.

In addition, the following figure (Figure II-2-3-8) compares the ratio of each component of real intangible asset investment to total real intangible asset investment in each country. Looking at the characteristics of Japan in particular, R&D is more weighted among developed countries, but organizational reform and human capital are particularly less weighted. These characteristics suggest that while Japan understands the importance of technological development, investment in the system of companies and in vocational training has been inactive.

Figure II-2-3-8. Allocation of intangible asset investment in each country

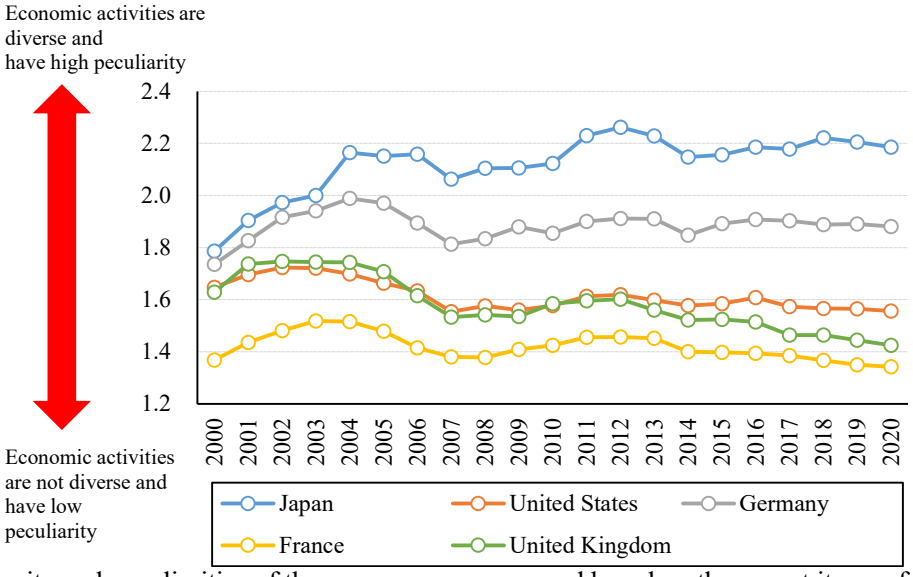




Sources: Research Institute of Economy, Trade and Industry for Japan, and INTAN-Invest for other countries.

R&D has a higher proportion of intangible asset investment in Japan than in other developed countries, and according to data from the Research Institute of Economy, Trade and Industry, about 70% of Japan's R&D investment is spent in the manufacturing industry, which is thought to contribute to maintaining the diversity of the Japanese manufacturing industry. Specifically, the economic complexity index is known as an indicator of how diverse and highly specialized the activities in the manufacturing industry of a given country are. Comparison of the index among the five countries covered in this section shows that the indexes for Japan and Germany are higher, which looks consistent with the higher weight on research and development in the two countries (Figure II-2-3-9). While there are arguments that globalization, such as the establishment of an international division of labor, and automation due to the development of robot technology, will reduce employment in the manufacturing industry, the diversity and peculiarities of the manufacturing industry as shown by the index may contribute to maintaining employment.

Figure II-2-3-9. Economic complexity indexes



Note 1: Diversity and peculiarities of the economy are measured based on the export items of goods.
Note 2: Aggregated on a 6-digit basis for HS96.
Source: The Observatory of Economic Complexity.

As investment in human capital and organizational reform is an explicit example, intangible asset investment is generally considered to be an investment to enhance the soft skills and sense of belonging of employees, and is thus expected to contribute to raising labor productivity. The table below shows the calculated correlation coefficients between the items included in intangible asset investment in each country and the year-on-year change in labor productivity (Table II-2-3-10). According to the table, there is a characteristic trend in Japan, and the year-on-year change in all of the components of intangible asset investment is positively correlated with the year-on-year change in labor productivity. In Japan, R&D accounts for about 40% of the total intangible asset investment, but the correlation with labor productivity is low at 0.15. In addition, organizational reform, which has a relatively high correlation coefficient with labor productivity, does not have a high share, and its share is low compared to other developed countries. However, the share in intangible assets for items with the highest correlation coefficients with labor productivity is not necessarily high in all of those countries, suggesting the difficulty of properly allocating resources to intangible asset investment.

Table II-2-3-10. Correlation between the components of intangible asset investment and productivity in each country

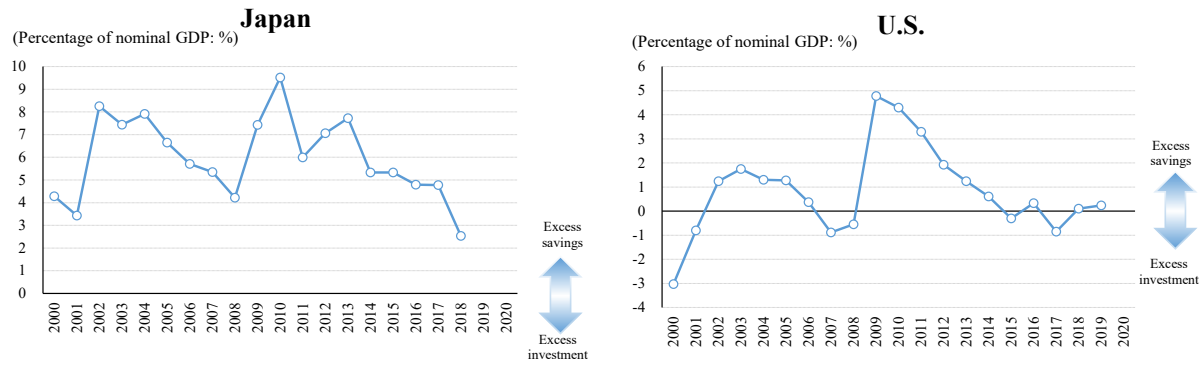
(Correlation coefficient with labor productivity: From 2000)	Japan	United States	Germany	France	United Kingdom
Software	0.50 (20.1%)	-0.13 (19.8%)	0.34 (11.0%)	0.46 (28.0%)	0.36 (18.7%)
Artistic creations, licenses, and mineral exploration	0.65 (10.6%)	0.41 (7.6%)	-0.55 (1.8%)	0.66 (1.6%)	0.03 (3.7%)
Design	0.25 (12.5%)	0.18 (9.2%)	0.46 (10.0%)	0.48 (8.1%)	0.26 (6.9%)
Product development in the	0.14	-0.28	-0.30	0.17	0.46

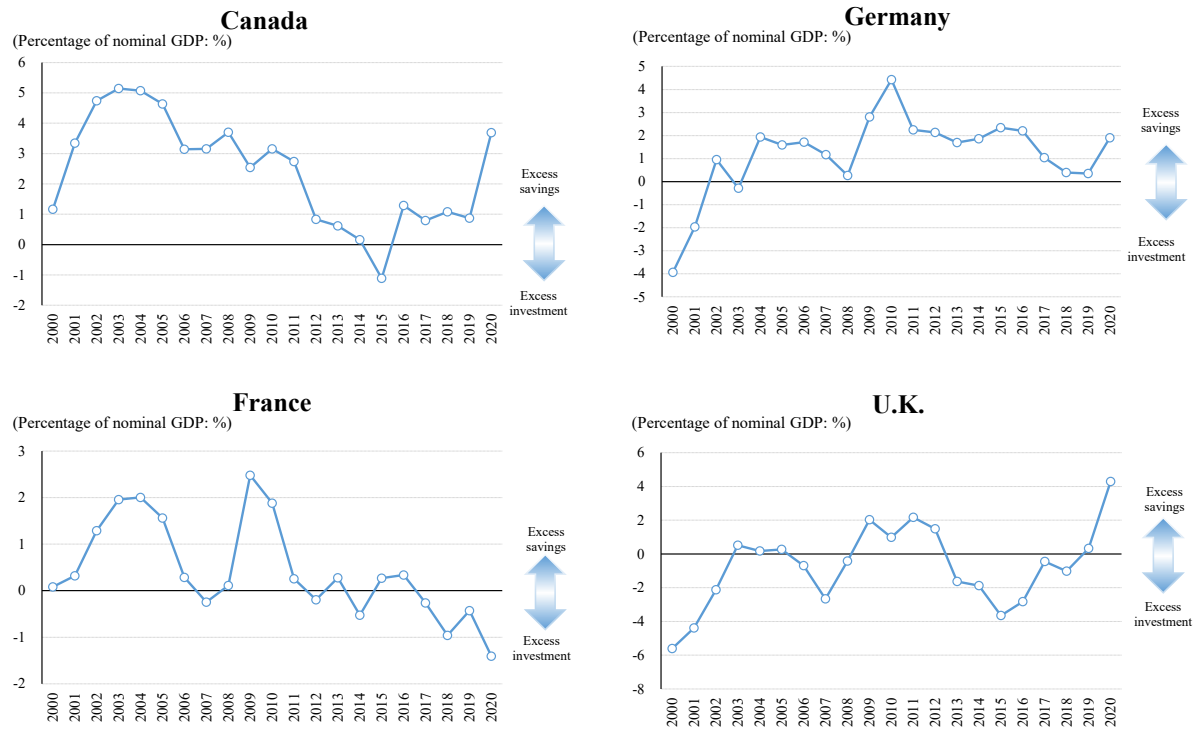
financial industry	(1.3%)	(2.0%)	(1.0%)	(1.1%)	(1.2%)
Research and development	0.15 (38.1%)	-0.33 (16.3%)	0.19 (35.1%)	-0.08 (19.2%)	0.22 (10.8%)
Brand	0.68 (7.5%)	0.06 (11.3%)	0.51 (7.7%)	0.42 (5.4%)	-0.08 (12.1%)
Organizational reform	0.60 (6.6%)	0.15 (22.0%)	0.39 (20.2%)	0.17 (27.1%)	0.68 (35.3%)
Human capital	0.26 (3.4%)	-0.45 (12.1%)	0.39 (13.2%)	0.26 (9.3%)	0.06 (10.9%)

Note 1: Correlation coefficients are measured from 2000 to the most recent year when the data is available, with France, Germany, and the United Kingdom up to 2017, the United States up to 2016, and Japan up to 2018.
Note 2: Parenthesized percentage numbers show the weights of each items in the total intangible asset investment for each country in the most recent data point.
Sources: Based on data from INTAN-invest, Research Institute of Economy, Trade and Industry, andOECD.

One of the reasons why the ratio of intangible asset investment to real GDP in Japan remains small compared to other countries is that Japanese companies tend to retain profits for crisis management and other purposes. Specifically, the figure below (Figure II-2-3-11) compares the operating surplus trends in the corporate sector in each country covered in this section. Around 2009, when the impact of the global financial crisis was severe, the size of operating surplus as the percentage of nominal GDP increased, with the exception of Canada, because companies likely became cautious about investing. On the other hand, the high percentage of nominal GDP of the operating surplus in Japan stands out in the post crisis periods, suggesting that companies tend to retain profits as reserves. While excessive borrowing and investment by companies will have a serious impact on the economy in times of recession, stable investment at normal times is also important from the viewpoint of economic growth, and it is desirable to develop a system that allows companies to become more active in investment, including intangible asset investment.

Figure II-2-3-11. Trend of operating surplus of companies in each country

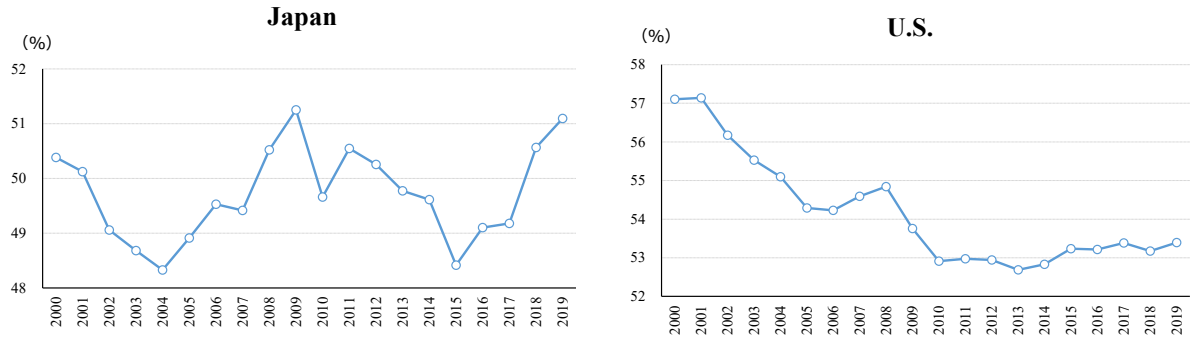


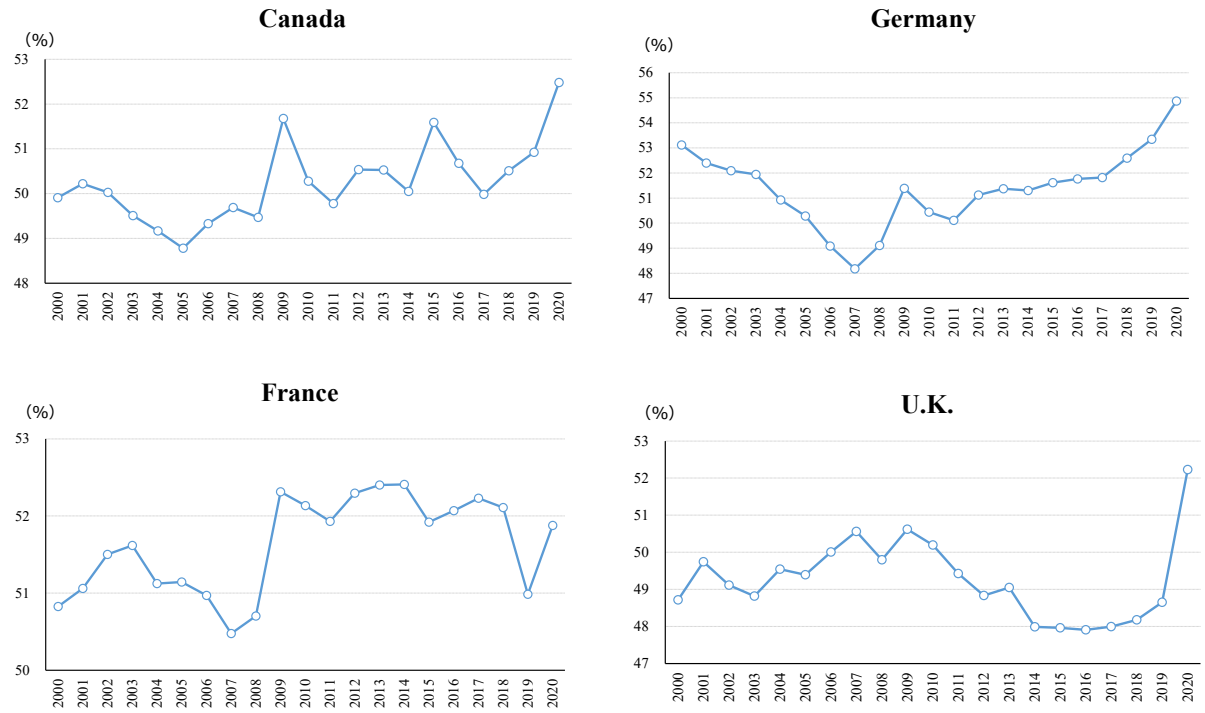


Source: OECD.

In addition, the trend in labor share is also important when looking at the distribution of funds to investment by companies. The figure below (Figure II-2-3-12) compares the labor share in each country covered in this section. While there has been a decline trend in the United States, the labor share in other countries, including Japan, has been increasing in recent years. In order to stabilize private consumption, it is important to increase the proportion of employee compensation. At the same time, it is also important to secure funds for investment for corporate growth, and it is necessary to maintain an appropriate balance between the two in line with the socio-economic situation of the country.

Figure II-2-3-12. Labor share in each country



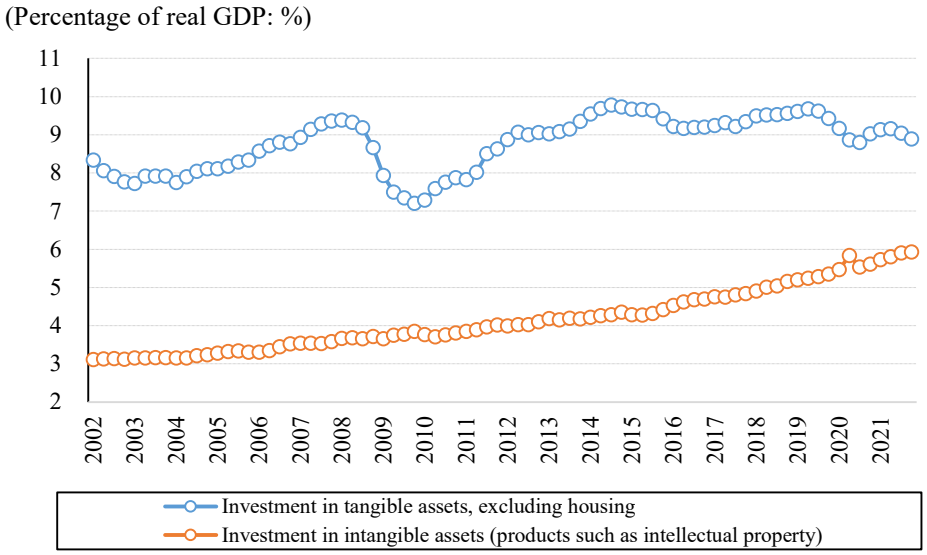


Note: Labor share (%) = Nominal Employee compensation / Nominal GDP.
Source: OECD.

In fact, the decline trend in the labor share seen in the United States means that the share of capital in added value is increasing. In other words, it means that, by increasing the share of added value obtained by companies, companies have more discretion to decide how to use their profits, such as investment and internal reserves. The trend of capital investment in the United States based on the National Accounts Statistics (Figure II-2-3-13) shows that as intangible asset investment in the on-going accounting manual is limited to R&D and software, the ratio of intangible asset investment in added value is lower[196] than tangible asset investment such as structures and machinery, but the intangible asset investment ratio is approaching that of tangible asset investment suggesting that companies are actively investing profits for growth, with an increasing focus on intangible asset investment.

[196] Corrado, Hulten, and Sichel (2006) pointed out that the size of intangible asset investment will exceed the size of tangible asset investment in the United States when intangible asset investment is defined more broadly.

Figure II-2-3-13. U.S. tangible and intangible asset investments in the National Accounts Statistics



Note: Figures are based on the current official statistics, the National Accounts Statistics, and note that items (R&D, software) included intangible asset investment (products such as intellectual property) are less than those of the intangible asset investment estimated by INTAN-Invest, which has been discussed in this section.
Source: Bureau of Economic Analysis.

5. Open innovation to promote the production of intellectual property

Considering the fundamental reason why so-called platform companies were able to establish a dominant position in the market, one of the main reasons is that they were able to generate ideas such as innovative business models. Specifically, as seen mainly in modern platform companies, the idea that data analysis such as detailed customer behavior using AI and other technologies is important as a source of earnings is one of the innovative ideas created by technological development.

Given the importance of creating ideas, concept of open innovation is attracting attention for the creation of innovative ideas and technological developments. According to Chesbrough (2004), "open innovation is the organic combination of corporate internal and external ideas to create value[197]." In other words, in order to generate ideas and technologies, it is important to build a system of cooperation not only within an organization but also with the outside as a whole (Table II-2-3-14). On the other hand, the traditional notion that everything should be done within an organization is called closed innovation.

Table II-2-3-14. Closed innovation and open innovation

	Closed innovation
Concept about workers	■ The best workers should be hired
	■ In order to benefit from R&D, it is necessary to carry out

[197] Chesbrough (2004).

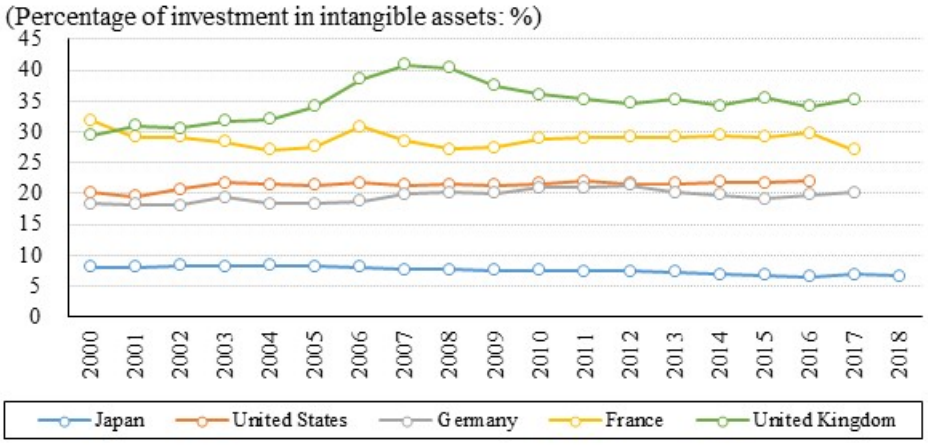
Concept about R&D	discovery, development, and commercialization on its own
	■ If you invent by yourself, you can be the first to put it on the market
Concept about profit creation	■ Companies that bring innovation to the market first will succeed
Concept about ideas	■ The one who creates the best ideas in the industry will win
Concept about intellectual property rights	■ Intellectual property rights should be controlled and other companies should be excluded

	Open innovation
Concept about workers	■ Excellent workers are not really needed in a company ■ It is good to work with excellent workers not only inside but also outside of a company
Concept about R&D	■ Great value can also be created through external R&D ■ Internal R&D is important to secure some of its value
	■ In order to gain profits, it is not necessary to conduct R&D from the basics
Concept about profit creation	■ Building an excellent business model is more important than putting products on market first
Concept about ideas	■ The most effective use of internal and external ideas will bring success
Concept about intellectual property rights	■ Should also consider developing your business model by obtaining profits from having other companies use your intellectual property rights, and/or purchasing the intellectual property rights of other companies

Note: Contents of closed innovation and open innovation were excerpted from those of Chesbrough (2004), and the classification on the left was added by the Ministry of Economy, Trade and Industry.
Source: Chessbrow (2004).

In the breakdown of the intangible asset investment, organizational reform is considered to be related to open innovation (Figure II-2-3-15). The definition of open innovation is that workers and ideas are widely sought outside an organization, and in fact, organizations such as companies should have flexibility as an organizational culture in order to take such actions. The estimation of the organizational reform includes expenditures on consulting services, and the more active for the reform the company is, including the improvement of organizational flexibility, the greater the related expenditures should become, activating not only internal interaction but also external interaction.

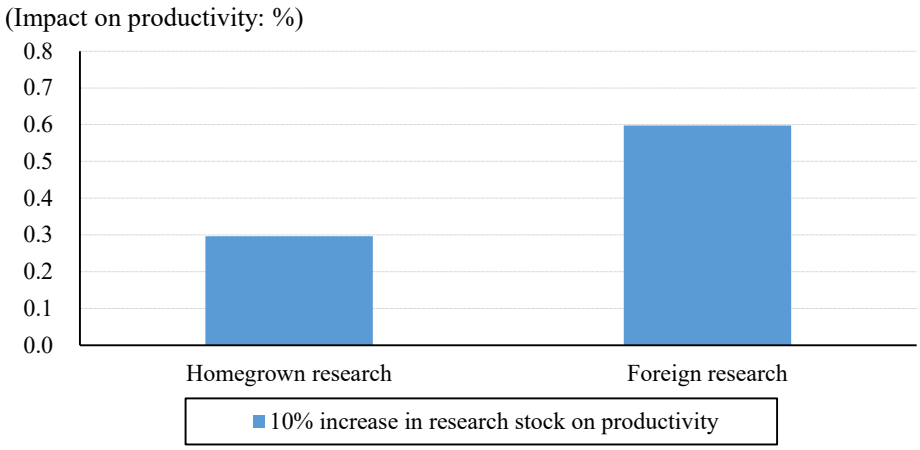
Figure II-2-3-15. Organizational reform ratio in developed countries



Source: Research Institute of Economy, Trade and Industry for Japan, and INTAN-Invest for countries other than Japan.

There are also empirical analyses that suggest that open innovation has a positive effect on labor productivity. The figure below shows how the increased accumulation of knowledge from research (research stock) affects labor productivity (Figure II-2-3-16). The results revealed a more positive impact of foreign research than homegrown research on productivity. The results suggest that the accumulation of knowledge in foreign countries should be utilized in order to improve labor productivity, and that open innovation is important not only from a micro perspective as an organization, but also from a macro perspective, such as incorporating ideas generated outside Japan.

Figure II-2-3-16. Effects of research stock on labor productivity

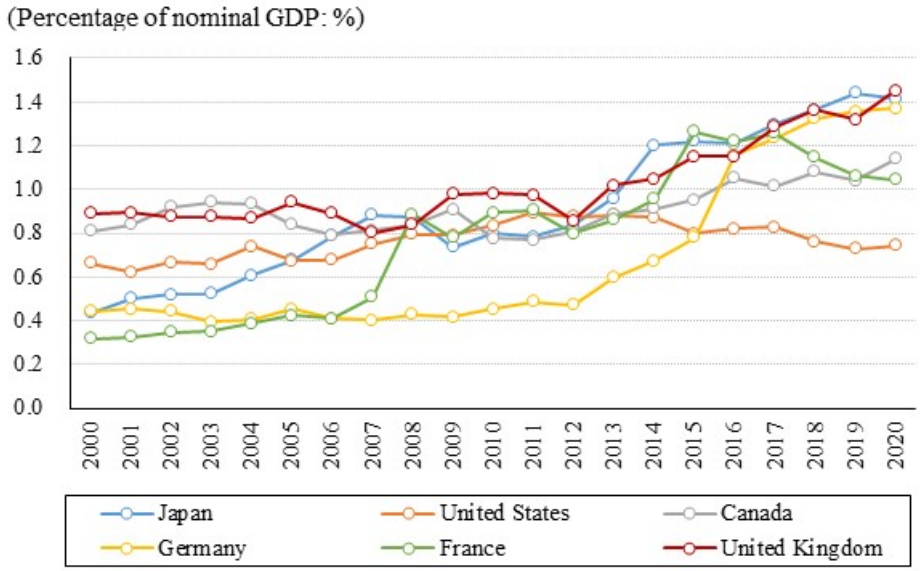


Note: The effect of a 10% increase in research stock on productivity (real GDP per worker).
Source: *World Economic Outlook October 2021* (IMF).

According to the definition of open innovation by Chessbrow (2004), it is important not only to increase profits by allowing other organizations to use their intellectual property, but also to utilize the intellectual property of other organizations. From this perspective, it would be useful to look at the total amount of intellectual property royalties received and paid relative to the economic scale as an

indicator of how active each country is toward open innovation. The following figure (Figure II-2-3-17) shows the total of intellectual property royalties received and paid as percentage of nominal GDP for countries covered in this section. The figure shows that the ratio has been increasing in a steady manner on the whole other than the United States, and that open innovation is diffusing between countries on a macro level.

Figure II-2-3-17. Total flow of intellectual property royalties



Note 1: Total flow of intellectual property royalties is the sum of intellectual property royalties received and paid.
Note 2: Due to a change in the aggregation method used by the Balance of Payments Statistics, data from 2005 onward is not strictly connected to prior data.
Source: UNCTAD.

As mentioned above, in open innovation, it is important not only to increase profits by allowing other organizations to use their intellectual property, but also to utilize the intellectual property of other organizations. However, the problem of instability regarding the attribution of intellectual properties can hinder open innovation as it is also important to provide appropriate rewards for inventors. In light of this, Japan made an important development in the employee invention system as the laws were revised in Japan in 2015. According to the definition in Japan's Patent Act, an employee invention is an invention achieved by an employee, falls within the scope of the business of the employer, and is achieved by an act categorized as a present or past duty of the employee performed for the employer. The system stipulates the handling of rights, remuneration, and other issues regarding employee inventions.

Looking at the employee invention system in other countries including Japan (Table II-2-3-18), the owner (primitive attribution) of the right to receive a patent created by the employee invention belongs to the user (i.e. the employer of the company) or to the inventor (i.e. the employee). In accordance

with the relevant laws, the right to obtain a patent is generally transferred to and taken over by the user from the inventor, and it is institutionalized to pay the inventor a reasonable amount of profit.

Table II-2-3-18 Employee invention system in Japan and other countries

	Relevant act	Primitive attribution of right to obtain a patent	Main points
Japan	Patent Act	Inventor (The employer when prescribed in advance)	■ In the case of an employee invention by an employee when it is prescribed in any agreement, employment regulation or any other stipulation providing in advance that the right to the grant of a patent for any employee invention is vested in the employer, the right to the grant of a patent belongs to the employer from its occurrence. ■ The employee has the right to receive a reasonable amount of money or other economic benefits.
United States	America Invents Act	Inventor	■ In order for a employer to own an employee invention, the employee inventor must transfer the invention to the employer and submit an application for the transfer to the U.S. Patent and Trademark Office. ■ If the employee and employer do not have an employment agreement, the primitive attribution of the patent basically belongs to the employee. However, if the employee was hired to make the invention, the primitive attribution belongs to the employer. ■ If there is an employment agreement, the primitive attribution of the patent depends on it, and the contract is judged by state law. ■ Shop right: In the absence of a written employment contract, the employer may still have the right to an employee's invention for which the employer paid a salary or provided materials, tools, or a workplace. ■ Even if there is a provision in the contract regarding the transfer of the invention, if the inventor refuses to sign the contract, it will be judged by federal law. (35 U.S.C. 118)
Germany	German Employee Inventions Act	Inventor	■ Contains provisions for not only inventions that are eligible for patent and utility model registration, but also proposals for technical improvements that do not fulfill patent and utility model registration conditions. ■ If the employer transfers the property rights to an invention developed as a result of employee's work, the employer is obligated to pay the employee a reasonable amount. ■ The employer may transfer any property rights that exist in relation to the invention developed as a result of employee's work to the employer itself by claiming the rights based on a manifestation of intention. ■ The employee who created the invention developed as a result of employee's work is obligated to submit a report to the employer stating so in writing without delay. ■ If the employer does not give a manifestation of intention to

			declare the invention as a free invention in writing within four months after receiving the report, it is deemed that the employer has claimed the rights. ■ If an employee creates a free invention within the period of employment, he/she shall notify the employer in writing without delay. ■ If the user does not repudiate to the employee in writing that it is a free invention before three months period have elapsed after receiving the report of the free invention, the employer may not later claim the right. ■ If the employee intends to utilize the free invention elsewhere during his/her employment period and the invention falls within the scope of a business that is currently in place or is being prepared by the employer, the employee shall provide at least a non-exclusive license in that take precedence over others under reasonable conditions. ■ Except in certain cases, the employer must file a patent (or utility model application). in Germany for the employee invention
China	China's Patent Law and its Implementing Regulations	Employer	■ The promise between the company and the inventor takes precedence over the attribution of the creation of any invention completed using the company's material and technical conditions. ■ The company granted the patent right must encourage the inventor or give them reasonable remuneration based on the economic benefits.
Canada	Patent Act	Inventor	■ Because there is no provision regarding the attribution of inventions and patents in employment relationships, any conflict between the employer and the employee shall be resolved by the court. ■ As a general rule, the ownership of the invention belongs to the employee unless an agreement is signed with the employer for the transfer of the rights.
United Kingdom	Patents Act	Employer	■ The rights to the employee invention belong to the employer. ■ The inventor has the right to acquire additional compensation, but the patent must be authorized in the UK or another country to acquire compensation, and the inventor must show that it will produce significant benefits for the employer. ■ Factors taken into account when calculating the amount of compensation include the nature of the employee's work, their amount of effort, the amount of contribution by other companies, and the amount of contribution by the employer.
France	Intellectual property Code	Employer	■ The primitive attribution of the employee invention belongs to the employer. ■ The employee has the right to receive additional compensation related to the employee invention. ■ The agreement between the employee and the employee regarding the invention made by the Employee shall be recorded in writing, otherwise it shall be invalid.

Netherlands	Patents Act	Employer	■ The patent rights are granted to the employer if the employee made the invention within the scope of his/her normal obligations and was employed for the purpose of making the invention using his/her own knowledge. ■ The employee has the right to demand fair remuneration ■ There are no clear guidelines for rewards, and the employer has the right to determine the form and amount of rewards.
Switzerland	Swiss Debt Act	Employer	■ The employer is granted the rights for all inventions created by the employee according to the employment contract. ■ There is no provision on additional compensation for the employee. ■ If the employee makes an invention that is not based on a specific obligation under the employment contract during the employment period, the inventor is obligated to notify the employer, and the employer shall indicate in writing within six months whether or not he/she will purchase the invention. ■ There are no guidelines on quantitatively evaluating fair remuneration for the inventor, but remuneration can be given through a contract.
Sweden	Act on the Right to Employee's Inventions	Employer	■ The employer has the right to acquire all or some of the rights to the invention made by the employee. ■ The inventor may receive a monetary remuneration other than a salary in exchange for transferring the rights to the invention to the employer. ■ Excluding provisions on reasonable remuneration, the law on employee invention does not apply to employees who have agreed to an inventor agreement either personally or through a labor union, and the employer automatically holds the rights to inventions made by the employee within the scope of the business.
Taiwan	Patent Act	Employer	■ Unless otherwise stipulated in the contract, the patent application and patent rights for any invention completed by the employee within the scope of his/her duties belong to the employer. ■ The employer must pay a reasonable amount to the employee. ■ Patent applications and patent rights for inventions that are not completed by the employee within the scope of his/her duties belong to the employee. However, if the invention was made using the employer's resources or experience, the employer may implement the invention if he/she pays a reasonable amount to the employee. ■ The method of calculating appropriate remuneration is not explicitly stipulated in the Patent Act or its Implementing Regulations, and the parties shall agree to an appropriate remuneration through a contract.
Republic of Korea	Invention Promotion Act	Inventor	■ If the employee acquires a patent or succeeds to the right to acquire a patent, the employer shall have a non-exclusive license in the right to the patent. ■ If the employer succeeds to the right to acquire a patent from the inventor, the inventor shall have the right to receive fair compensation.

			■ An employee who completes an employee invention is obligated to notify the employer of the completion. ■ The employer is obligated to notify the employee as to whether the employer will succeed to the rights to the invention. ■ If the employer does not notify the employee as to whether the employer will succeed to the rights to the invention, the invention is regarded as a free invention.
India	Contract Act	Employer	■ The attribution of the invention made by the employees is determined based on the employment contract. ■ There are no specific provisions on the compensation for the inventor. ■ Under a general employment contract, all inventions created by the inventor, the employee, are automatically transferred to the company, the employer.
Brazil	Industrial Property Law	Employer	■ If the invention originates from an activity intended for research or invention or from the nature of the employee's work, the invention belongs exclusively to the employer. ■ Unless otherwise stipulated in the contract, the employee shall be rewarded up to the agreed salary. ■ The employer may give the inventor a share of the economic benefits from the implementation of the invention in consultation with stakeholders or in accordance with the company's rules. ■ If the invention was made as a result of the employee's contribution and the use of the employer's resources, facilities, equipment unless otherwise stipulated in the contract, the invention shall be shared equally between the parties.
Russia	Civil Code	Employer	■ An invention made by an employee as part of his or her job or a task specified by the employer is considered an employee invention. ■ If the invention does not originate from the employee's work or a task specified by the employer, it is not considered an employee invention, and the employer has the rights to only acquire a non-exclusive license or to only ask the employee to reimburse the costs incurred by the employer. ■ If the employer notifies the employee of the acquisition of the employee invention, an attempt to conceal expertise, the employee has the right to request payment. ■ The amount, conditions, and procedures for payment by the employer shall be determined by the contract between the employer and the employee.
Thailand	Patent Act	Employer	■ The right to receive a patent for an invention made under an employment contract or a contract for the performance of certain work shall belong to the employer, unless otherwise stipulated in the contract. ■ Even if the activity for the invention is not required under the employment contract, the employer has the right to acquire the patent if the invention was made using means, data, or reports freely available to the employee. ■ If the employer receives benefits from an invention made by the employee, the employee has the right to receive

			remuneration in addition to the normal wage, and this right cannot be excluded by the terms of the contract.
Indonesia	Patent Law	Employer	■ Unless otherwise provided in the employment contract, the employer shall have the right to receive a patent for an invention made by the employee. ■ Even if the invention is not required under the employment contract, the employer shall have the right to receive the patent if the invention was made using materials and equipment available to the employee within the scope of his/her duties. ■ The inventor shall have the right to receive a reasonable amount of payment in consideration of the economic benefits gained from the invention.
Singapore	Patents Act	Employer	■ Generally, the employment contract includes a clause that stipulates that the rights related to intellectual property are transferred to the company. ■ Any clause related to employee inventions must not be interpreted to preclude any agreement or contract related to rights regarding inventions.
Vietnam	Intellectual property Law	Employer	■ Unless otherwise agreed upon, an employer who has provided funds and physical facilities to an employee in the form of assignment or employment shall have the right to receive a patent. ■ Unless otherwise agreed upon, the employer is obligated to pay remuneration to the inventor.
Philippines	Intellectual Property Code	Employer	■ The intellectual property rights of the employer and the employee are governed by the contractual clauses between the parties. ■ If the invention is the result of the performance of duties regularly assigned to the employee, the patent belongs to the employer unless otherwise expressly or implicitly agreed. ■ If the invention is not part of regular duties, the patent belongs to the employee even when the employee uses the employer's time, equipment, and materials.
Malaysia	Patent Act	Employer	■ If the employment contract does not include a clause allowing the inventor to claim ownership, the right to obtain a patent shall be deemed to belong to the employer. ■ If the invention produces economic profit larger than that which was reasonably foreseeable at the time of the employment conclusion, the inventor is entitled to receive a fair reward. ■ It is prohibited to limit the employee's right to claim compensation from the employer by means of a contract.

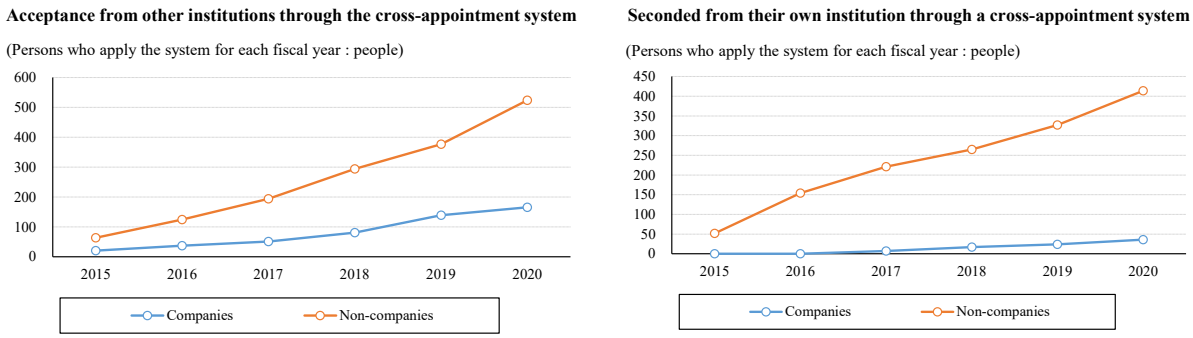
Note: In the table, "inventor" generally means an employee and "employer" means a corporate employer.
Source: Japan Patent Office's website (for Japan), and *Report on investigation and research for employee's inventions in Japan and overseas countries* (2013, Japan Patent Office) (for overseas countries).

In Japan, the amendment of the Patent Act in 2015 made it possible for employers to have the right to obtain a patent if it is prescribed in advance in a contract or working regulations, where it had been previously stipulated that employees had the right to obtain a patent. This amendment alleviated the

burden of administrative procedures, as the right to obtain a patent used to belong to the employee and then had to be transferred to the employer, and also solves the problem as to where the employee transfers the right to obtain a patent especially in a case when an employee intends to transfer the right to a third party that is not his/her place of employment. The guideline established and published by the Minister of Economy, Trade and Industry based on the Patent Act specifies more concretely the factors to be considered in determining whether it is unreasonable to provide reasonable benefits as stipulated in contracts. It clarifies the principle that, in determining unreasonableness when a contract sets forth "reasonable benefits", whether the status of processes explained to the Japan Patent Office is reasonable is taken into account, and, as long as such processes are deemed appropriate, contracts established in advance by the employer and employee will be respected, resulting the denial of the unreasonableness. These amendments likely have reduced the risk for companies to make extensive use of internal and external intellectual properties through open innovation.

As mentioned above, the Patent Act was amended in Japan and likely reduced the administrative burden associated with hiring employees engaged in employee invention, but there are still issues to further promote open innovation. More specifically, the figure below (Figure II-2-3-19) shows trends in the number of research staff of academic institutions who used the cross-appointment system. The cross-appointment system allows researchers to enter into employment contracts with multiple organizations including universities, public institutions, and private companies. Trends in the number of research staff of academic institutions who used the system indicate that the number of receptions and temporary transfers by companies is significantly lower than those by non-companies (universities, R&D entities, and other institutions).

Figure II-2-3-19 Implementation of the cross-appointment system

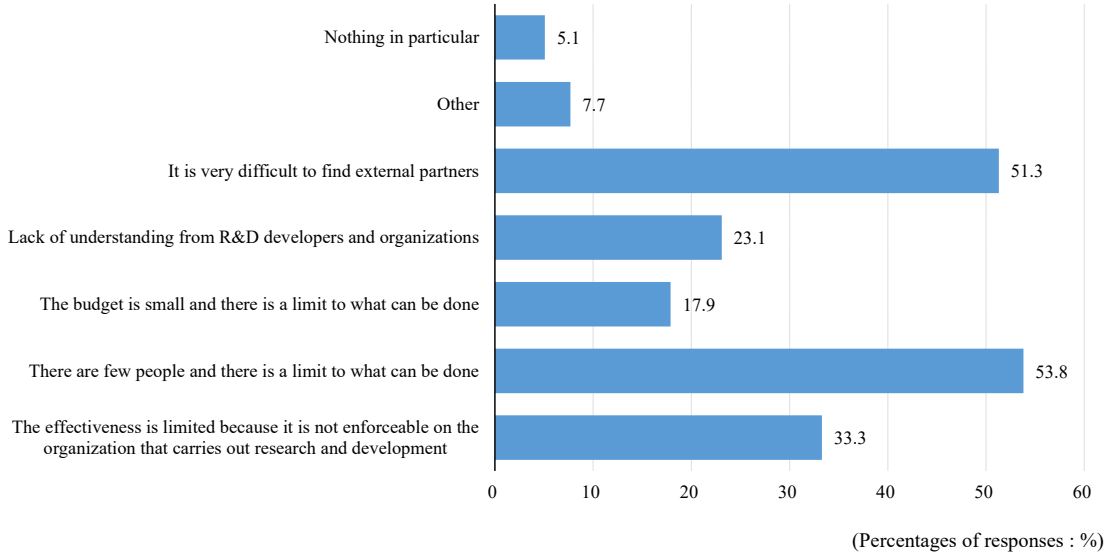


Source: *Status of industry-academic cooperation in universities* (Ministry of Education, Culture, Sports, Science and Technology).

According to the second edition of the White Paper on Open Innovation, 51.3% of the companies that said in their responses to the survey questionnaire that they are more active in open innovation than 10 years ago answered that "it is very difficult to find external partners" to promote open innovation (Figure II-2-3-20). The survey was conducted in FY2015, but given that the use of the cross-appointment system by companies remains at a low level, it is possible that the situation has not

changed significantly since then. It is suggested that it is important to promote the active use of this system.

Figure II-2-3-20 Problems and issues of the mechanism for promoting open innovation



Note: 195 companies responded to the question, "Are open innovation efforts more active than 10 years ago?" The figure is based on 39 of the 45.1% of companies that answered, "It is more active".
Source: *Second edition of the White Paper on Open Innovation* (Japan Open Innovation Council, and New Energy and Industrial Technology Development Organization).