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1.2.1 Innovation and the rise and fall of firms

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1 The vicissitudes of fortune

Countless companies have enjoyed rapid success by taking advantage of the growth opportunities presented by technological advances. Facebook and Twitter are examples in the rapidly growing field of social media. Google, which has achieved rapid growth in Internet-related businesses centering on Android OS, and Qualcomm, which sets industry standards in mobile communications technology and semiconductor design, are also representative of such success.

On the other hand, there have been cases where companies have been forced to exit the market after losing out to competition from new entrants benefiting from the fruits of technological innovation. For instance, with the advance of electronic technologies, silver halide cameras and films have been replaced by digital cameras, and many silver halide film manufacturers, including Eastman Kodak, the largest company in the industry, have recently been forced out of business. Indeed, the only company in the film industry to substantively survive was Fujifilm, which pivoted its main business into something other than film. The time required for the central players in an industry to change their standing in the market is shorter than ever before.²

A review of the historical changes in the faces appearing in the Fortune 500 rankings in the US reveals a dramatic shift in the leading roles. For example, only 80 of the companies ranked in the top 500 in 1955 made the list in 2005, just 50 years later.³ Of course, even in the United States, where leading roles change rapidly, there are major companies such as GE, Procter & Gamble, Boeing, DuPont, 3M, and Johnson & Johnson that have always led technological innovation as industry leaders and have maintained their market

1 Hitotsubashi University Institute of Innovation Research

2 Stalk (1990)

3 Refer to the following website for specific companies:
http://archive.fortune.com/magazines/fortune/fortune500_archive/full/1955/

positions for a long time while fending off challenges from new players. However, is not easy to maintain such a market position for long periods of time.

2 First-mover advantage and appropriability

2.1 First-mover advantage and the leakage of the results of innovation

The advantage gained by acting ahead of other competing companies is known as the “first mover’s advantage.”⁴ First-mover advantages include the following: 1) monopoly over profits for a certain period of time (i.e., as a pioneer company in the industry, you can set higher prices and customers are willing to pay higher prices), 2) involvement in setting standards (i.e., as a pioneer company in the industry, you can be involved in setting industry standard processes), 3) patent acquisition (e.g., creating a technological barrier in the form of a patent, preventing other companies from entering the market), 4) the experience curve effect (i.e., by reaching mass-production ahead of other companies, you can learn how to produce your product at a lower cost), 5) first to purchase resources (i.e., you can monopolize scarce resources ahead of other companies), 6) buyer switching costs (i.e., you create the costs required for customers to switch suppliers, making it easier to retain customers once acquired),⁵ and 7) network externalities (i.e., by expanding the size of the network ahead of other companies, the benefits to network users increase as the size of the network increases).⁶ However, these first-mover advantages do not always materialize. On the contrary, in some cases, there may be what is called a “latecomer’s advantage,” that is, an advantage that arises from acting after other players.

2.2 The possibility of securing profits through innovation

2.2.1 The possibility of securing profits (appropriability)

The concept of “appropriability” is key to understanding whether and to what extent a pioneer can secure for themselves the fruits of an innovation that they have created. It refers to “the extent to which one can secure for oneself the economic value derived from an innovation.” A state with a very high degree of profit security is one in which the economic fruits of the innovation are almost entirely one’s own. In contrast, a state with a very low degree of profit security is one where there is little chance of securing the fruits of an innovation for oneself and the economic benefit is taken by other companies.

Factors affecting the extent to which profits can be secured include: 1) lead time (i.e., how much time elapses between the first and second mover), 2) legal protection (i.e., to what extent the technology is protected by intellectual property rights such as patents, design rights, copyrights, and so on), 3) the

4 Lieberman and Montgomery (1988) First-mover advantages. *Strategic Management Journal*, 9: 41–58.

5 Also referred to as “switching cost.”

6 Imagine a situation where it is more advantageous because a family member or friend has a contract with the same cell phone company than one where it is not.

technology's ease of imitation (i.e., to what extent the content of the technology is observable and reproducible by the second mover), and 4) the importance of complementary assets and the possession thereof.⁷

Although they are important, short lead times, inadequate legal protection, easily imitated technology, and insufficient complementary assets can result in companies losing out in market competition even if their technology is superior. Legal protection is the extent to which ownership of the developed technology is protected by law. Dealing with intellectual property rights is often a key management issue when expanding business in emerging countries where legal protections are not yet in place. Even in the development of cutting-edge technologies, monitoring for imitation by other companies is an important management issue.

Ease of imitation: Some technologies are easy to imitate and some are difficult, depending on the nature of the technology. Technology that can be objectively and explicitly expressed as formal knowledge is easily imitated. On the other hand, it is difficult for competitors to imitate operational know-how that is difficult for other companies to observe, production technology, and nuanced know-how because such knowledge exists as tacit knowledge embodied in people and organizations. Products that encompass a wide range of elemental technologies also tend to be difficult to imitate⁸ because it becomes difficult for other companies to reproduce all the complexity of elemental technologies with the same performance. In this respect, the complexity of product technology is another factor affecting the ease of imitation. It is sometimes difficult to observe what the sources of competitive strength are in the eyes of competitors and to identify the causes.⁹

Complementary assets: In order for a newly developed technology to be successful as a business, it requires complementary capabilities, such as equipment and machinery to produce the product or service, a sales network to sell it, and a service network to help users use and maintain it. For example, bringing a new frozen food product to the market requires a so-called cold chain of cold storage warehouses, refrigerated trucks, and grocery stores and supermarkets with refrigerators in which to display the frozen food. These are the assets that provide the complementary capabilities needed to deliver the intrinsic value of new frozen foods to customers. Regardless of how successful the development of an excellent frozen food product, unless you own or use such complementary assets, you will not be able to own the fruits of your innovation. If the complementary assets are available to all, then there are no such issues. Essentially, if the complementary assets are specific and unique to the product or service developed, and if they are concentrated within a particular firm, making it difficult for other firms to use those assets, or it takes time and money to acquire or build new assets, the firm that owns the assets will have strong bargaining power in the distribution of the fruits of the innovation.

⁷ Regarding complementary assets, see Teece (1986).

⁸ However, even tacit knowledge that is relatively difficult to imitate may be embodied in manufacturing equipment or people involved in manufacturing, resulting in the leakage of technology and know-how to competitors. Consider a case where your competitors use the same manufacturing equipment and machinery, or where your best engineers move to a competitor.

⁹ Refer to Reed and DeFillippi (1990) for more detail.

If the appropriability of the “innovator”—that is, the entity that succeeds in technological innovation ahead of others—is low, even if the innovator develops a new product as a first mover, they will be attacked by existing companies and new entrants imitating the new product. As a result, some companies leave the market stage without fully enjoying the fruits of their innovation. For instance, EMI in the UK, which won a Nobel Prize for developing CT scanners, was eventually forced out of the business. The same fate befell DeHavilland, a pioneer in jet engines for commercial airliners, and RC Cola, the first company to introduce diet cola to the world. Similarly, IBM succeeded in making MS-DOS the industry standard for personal computer operating systems (OS), but lost the fruits of its success to Microsoft.

Table 1.2.1.1 shows the results of a questionnaire survey on the effectiveness of appropriability measures of Japanese and US companies.¹⁰

Table 1.2.1.1.

	Product innovation		Process innovation	
	Japan	US	Japan	US
Secrecy of technical information	25.6%	51.4%	28.9%	52.7%
Patent protection	37.8%	35.7%	24.8%	23.9%
Other legal protection	16.3%	20.3%	11.8%	15.0%
Marketing the product first	40.7%	51.8%	28.2%	38.0%
Ownership and management of sales and service networks	30.0%	41.9%	22.7%	29.0%
Possession and management of manufacturing facilities and know-how	33.1%	45.5%	36.1%	43.3%
Complexity of production and product design	20.2%	40.0%	22.0%	38.6%
Others	6.5%	8.6%	6.6%	8.0%

Note: The outcomes through questionnaire from main industries in Japan (643 cases) and US (1,478 cases) in 1994. Percentage of the innovations in the last three years that have been effective as a means of ensuring appropriability.

In Japan, the most effective method of product innovation involves marketing the product first (40.7 percent), followed by patent protection (37.8 percent), ownership and management of manufacturing facilities and know-how (33.1 percent), and ownership and management of sales and service networks (30.0 percent). In respect to process innovation, the most common responses were possession and management of manufacturing facilities and know-how (36.1 percent), confidentiality of technical information (28.9 percent), and bringing products to market first (28.2 percent). This shows that while patents are important,

¹⁰ Goto Akira and Nagata Akiya (1997).

being first to market and possess complementary assets are equally important. In contrast, for product innovation in the US, bringing a product to market first was the most important factor (51.8 percent), followed by secrecy of technical information (51.4 percent). In terms of process innovation, the most common responses were confidentiality of technical information (52.7 percent), possession and management of manufacturing equipment and know-how (43.3 percent), and complexity of production and product design (38.6 percent). Both the situation and points of emphasis seem to differ between the two countries.

Revenue protection measures also vary widely across industries. Table 1.2.1.2 shows the share of revenue protection methods by industry. Industries are broadly divided into lifestyle-related industries, basic materials manufacturing, and processing and assembly manufacturing. Representative examples of the basic materials and processing and assembly manufacturing include the chemical and steel industries, information and communications machinery and equipment industries, and transportation machinery and equipment industries. Table 1.2.1.2. illustrates the diversity of the manufacturing industry.

Table 1.2.1.2.

Industry classification	Total number of firms	Share of revenue protection methods of Product / Process innovation (%)					
		Utilization of patent protection	Utilization of other legal protection	Introducing products and services ahead of competitors	Increasing the complexity of production and product design	Secrecy of manufacturing technology/methods and sales methods	Others
All industries	331,037	5.7	6.0	13.8	7.9	7.9	0.5
Lifestyle-related industries	31,637	8.8	15.2	21.4	21.8	12.6	0.2
Basic materials manufacturing	29,722	14.8	12.7	18.4	15.0	16.0	1.7
(Chemical industries)	2,378	33.4	23.8	29.9	20.0	33.2	0.6
(Steel industries)	1,897	11.4	4.4	14.9	11.0	13.8	0.2
Processing and assembly manufacturing	31,873	15.9	9.9	21.0	15.5	19.7	0.4
(Information and communications machinery and equipment industries)	1,492	15.4	8.0	16.3	15.9	13.0	1.3
(Transportation machinery and equipment industries)	5,583	16.0	13.5	25.7	14.9	29.8	1.0

Note: "Lifestyle-related industries" includes Food manufacturing industry, Beverage, Tobacco, Feed manufacturing industry, Textile industry, Furniture, Equipment manufacturing industry, Printing industry, Leather and fur manufacturing and Others. "Basic materials manufacturing" includes Wood manufacturing, Pulp and paper manufacturing industry, Chemical industry, Oil and coal manufacturing industry, Plastic and rubber manufacturing industry, Ceramics and stone products industry, Steel industry, Non-ferrous metal manufacturing industry and Metal product manufacturing industry. "Processing and assembly manufacturing" includes General-purpose machinery manufacturing industry, Production machinery, Commercial machinery, Electronic parts, devices and electronic circuit manufacturing industry, Electric equipment manufacturing industry, Information communication equipment manufacturing industry and Transportation equipment manufacturing industry.

Source: NISTEP REPORT No.144 (All industries), Sep, 2010

In the chemical industry, patents are most common, followed by the secrecy of manufacturing technology/methods and sales methods. In contrast, in the steel industry, which is also a materials-based manufacturing industry, the primary strategy involves introducing products and services ahead of competitors. In the information and communication equipment industry, which is a processing and assembly industry, the main priority is introducing products and services ahead of competitors, followed by increasing the complexity of production and product design. Concealment of the manufacturing technology/method or sales method is most common in transportation machinery and equipment, including automobiles. As different industries have different methods of protecting their revenues, so the technical strategies they should pursue should differ accordingly.

2.2.2 Issues inherent in monopoly interests

The effort to create something out of nothing and the risk-taking that this involves are commendable acts. Companies that are ahead of the innovation curve will be motivated to harvest for themselves all the economic value that can be derived from it. However, there are points to keep in mind regarding imitation by competitors. Indeed, the policy of keeping the fruits of innovation exclusively to oneself and having as few competitors as possible is not always the right one.

The typical means of capturing the fruits of innovation involves monopolizing the market by reducing the number of competitors. However, it is sometimes important to increase the number of competitors, not only because monopoly conditions reduce further business efforts by firms that have succeeded in creating a monopoly, but because isolationism and exclusivism can have a negative effect on the development of the market itself. As the number of competitors increases, new entrants can also be expected in the form of new upstream suppliers of materials and components. Increasing the number of competitors will also foster the development of upstream suppliers. Similarly, as the number of competitors increases, so the downstream customers who purchase products from those competitors will have more purchasing options and a more stable purchasing experience. For instance, in the B2B world, and the automobile and semiconductor industries in particular, it is common to purchase and procure products with the same function from several different companies with the aim of ensuring stable supply. An increase in competition and the presence of other companies in the same industry will increase awareness of new products and services among customers. It will also make it possible to share in the education and training of customers and the development of infrastructure.

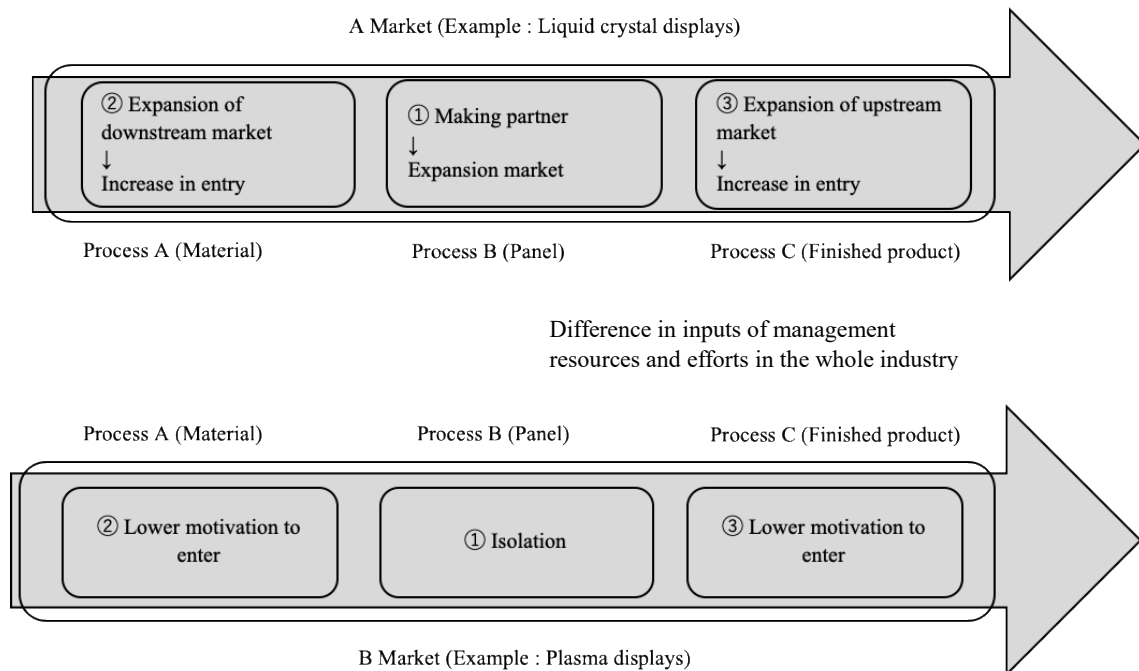


Figure 1.2.1.1.

By increasing the size of the industry through more competitors, we can expect a complementary goods industry to develop, with complementary functions. As a result, an increase in the number of competitors can be expected to improve and advance technology at various levels, both upstream and downstream, and expand the market, an effect that cannot be achieved where a specific company has a monopoly. For example, in the flat-screen TV industry, market competition has been based on different technological methods, plasma displays and liquid crystal displays (LCDs), and it was initially thought that the two would be separated by display size. However, LCDs have since achieved significant improvements in cost and performance, and come to dominate the market. This is partly due to the fierce competition that occurred upstream, midstream, and downstream, which encouraged the development of upstream industries and complementary suppliers and the entry of a variety of TV set makers (see Figure 1.2.1.1). In this respect, isolation reduces the willingness of upstream firms to enter the market. If the number of upstream suppliers does not increase, the company's strengths will not be increased. As a result, the willingness of downstream firms to enter the market is relatively low. However, there was fierce midstream competition, which led to upstream and downstream market entry and fierce competition in the LCD space. This is thought to have resulted in large differences between plasma and LCD in terms of management resource input and management effort across the entire value chain. This has resulted in significant improvements in the performance and cost of LCD displays.

When a company does not have its own production capacity or sales and service network, it may be less risky and more fruitful to license to a company that has such complementary assets. For example, although Intel withdrew from one of its core businesses, the DRAM business, in 1985, after losing out to competition from Japanese companies, it granted Japanese companies the rights to become a second source manufacturer for the MPU business on which it had become focused. At first glance, allowing Japanese companies that had backed Intel into a corner to produce substitutes for the products of Intel's remaining core business might appear to be doing the enemy a favor, and self-defeating in the short term. However, the strategy of using the Japanese company's rapidly growing production capacity to expand market opportunities for Intel's core business, which would have been impossible for the company to do on its own, and then eliminating the Japanese second source manufacturers once its own business had made significant developments and switched to in-house investment, is a good example of a strategy drawing on the strength of other companies to increase one's own competitiveness.¹¹

In some cases, such as overseas markets, it is impossible to enter without partnering with a local company. In some cases, this is driven by the government policy of the country into which they are expanding; in other cases, companies are forced to do so because of the unique lifestyles, culture or customs in the country. Increasing both the number of consenting competing manufacturers in order to set industry standards and the number of users is very important for products with strong network externalities. In some cases, it is important to cooperate with outside companies, including competitors, rather than keeping new

¹¹ Karube Masaru (1998).

technologies to oneself. In addition to the traditional concept of competition, the concept of “co-creation,” in which value is created together with various businesses, is also important.¹²

This paper is a summary of Chapter 3 of Hitotsubashi University’s Institute of Innovation Research (2017), please refer to this work for further detail.

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¹² Refer to the following two books in relation to this point: Brandenburger (1998) Adner (2012).

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